

# NEPAL DEVELOPMENT UPDATE

October 6, 2022



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October 6, 2022

# ACKNOWLEDGEMENTS

The Nepal Development Update is produced annually to report on key economic developments that occurred during the year, place them in a longer-term and global perspective, and to examine (in the Special Focus section) topics of particular policy significance. The Update is intended for a wide audience including policy makers, business leaders, the community of analysts and professionals engaged in economic debate, and the general public.

This report was produced by the World Bank Macroeconomics, Trade and Investment (MTI) team for Nepal consisting of Florian Blum (Senior Economist, MTI), Alice J Brooks (Senior Economist, MTI), and Nayan Krishna Joshi (Economist, MTI). The first part of the report was produced by Florian Blum (Senior Economist, MTI), Alice J Brooks (Senior Economist, MTI) and Nayan Krishna Joshi (Economist, MTI). The Special Focus Section was prepared by Alice J Brooks (Senior Economist, MTI), Thi Thanh Bui (Economist, EMFMD), and Biying Zhu (Extended Term Consultant, MTI). Calibration of and estimations performed by the MFMod-CC model were undertaken by Thanh Bui. Inputs were received from Nethra Palaniswamy (Senior Economist, POV) and Prashant Raj Pandey (Economist, ESAF1). The hydropower investment plan was developed by Rabin Shrestha (Senior Energy Specialist, ISAE1) and Fanny Missfeldt-Ringius (Lead Energy Specialist, ISAE1). The report benefitted from consultations with Dr. Prakash Kumar Shrestha (Executive Director, Nepal Rastra Bank). The team thanks Mathew Vergis (Director, Equitable Growth, Finance and Institutions (EFI), South Asia Region), Faris Hadad-Zervos (Country Director for Maldives, Nepal and Sri Lanka), Lada Strelkova (Manager, Operations), Shabih Ali Mohib (Practice Manager, MTI), and Tae Hyun Lee (Lead Country Economist, EFI) for their guidance and comments on the report. Andrew Burns (Lead Economist, EMFMD) provided helpful advice on the content of the special focus section. Akash Shrestha and Avinashi Paudel managed media relations and dissemination. Anima Maharjan managed the publication process.

The cutoff date is September 20, 2022, and includes data released up until that date.

# CONTENTS

<b>ACKNOWLEDGEMENTS</b>	<b>2</b>
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<b>EXECUTIVE SUMMARY</b>	<b>5</b>
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## **A RECENT ECONOMIC DEVELOPMENTS** **13**

A.1 Real Sector	14
A.2 External Sector	17
A.3 Monetary and Financial Sector	20
A.4 Fiscal Sector	24

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## **B OUTLOOK, RISKS, AND CHALLENGES** **29**

## **C SPECIAL FOCUS: THE MACROECONOMIC IMPACTS OF CLIMATE CHANGE IN NEPAL** **35**

C.1 Climate Context	37
C.2 Development Context	38
C.2.1 International Migration and Remittances	38
C.2.2 The Macroeconomic Impact of Air Pollution	40
C.2.3 The Macroeconomic Impact of Hardening Built Infrastructure	41
C.2.4 Hydropower Expansion and the Impact on Macroeconomic Stability	43
C.3 Modeling the Impact of Climate Change on the Nepali Economy	45
C.3.1 Baseline MFMod-CC Macroeconomic and Growth Scenario	45
C.3.2 Modeling the Macroeconomic Impact of Warming Scenarios – RCP 2.6, 4.5, and 8.5	46
C.3.3 Channels of Transmission of Climate Change Impacts	47

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## **ANNEX**

Annex C.1: Macroeconomic Forecasts under Climate Scenarios	50
Annex C.2: The Macro-Climate Model MFMod-CC	51



The background features a night photograph of a river scene. On the left, there's a building with a red light, and the water reflects the surrounding environment. The rest of the background is a dark blue gradient with a subtle geometric pattern of small triangles.

# EXECUTIVE SUMMARY

# EXECUTIVE SUMMARY

## PART 1: RECENT ECONOMIC DEVELOPMENTS AND OUTLOOK

### RECENT ECONOMIC DEVELOPMENTS

Nepal's economy has emerged forcefully from the pandemic.

A strong recovery in domestic demand has driven growth. Movement restrictions in combination with an almost complete shut-down of tourism during the COVID-19 pandemic resulted in Nepal's first economic contraction in almost 40 years in FY20 (-2.4 percent). A decisive vaccine roll-out and the reopening of borders have supported the economy's recovery, with growth estimated to have accelerated to 5.8 percent in FY22. Strong growth in domestic demand for consumption and investment was the main driver of the recovery.



**A rapid increase in domestic demand has fueled imports.**

Imports have recovered much faster than Nepal's traditional external financing sources. Due to a variety of structural constraints<sup>1</sup> Nepal's domestic production of consumption and investment goods is limited, which means that the country relies predominantly on imports to meet domestic demand. As a result, the demand-led recovery after COVID-19 was also accompanied by a surge in imports. This surge peaked in late 2021 and has moderated since then. In contrast to imports, remittances, Nepal's traditional source of foreign exchange earnings, have not grown substantially during the pandemic due to restrictions on international travel and have only begun accelerating since March 2022. Service export earnings are also growing more slowly as the country reopens for tourism. They remain below pre-pandemic levels as many Chinese tourists have yet to return.

**With imports outpacing foreign exchange earnings, Nepal drew down on foreign exchange reserves to finance trade.**

At the beginning of the pandemic Nepal accumulated a substantial buffer of foreign exchange reserves, due to both a slump in imports and new concessional loan disbursements. As imports outpaced foreign currency earnings during the recovery phase, Nepal used its reserves to finance imports, chipping away at the reserves stock until it was once again at pre-pandemic levels. Now that remittances and service exports are rising and the import boom abating, reserves are beginning to stabilize and covered 6.9 months of imports in the most recent data. This is above the optimal level of 5.5 months recommended by the IMF,<sup>2</sup> and close to the central bank policy floor of 7 months of import cover.

**Import demand was financed by lenient credit policies.**

Aiming to support households and firms, the Nepal Rastra Bank (NRB), the country's central bank, pursued an accommodative policy stance for most of the pandemic. In addition to a low policy rate, the NRB maintained a generous loan refinancing facility for small and medium firms, loan repayment facilities, and relaxed lending standards. These measures contributed to lowering lending rates early in the pandemic and fed a subsequent credit boom.

**The Russian invasion of Ukraine, through its impact on commodity prices, has also increased imports and inflation.**

The war impacted the country primarily through increasing global commodity prices. This had two effects. First, due to a low short-term demand elasticity, the value of fuel and commodity imports rose. Total fuel and lubricant imports for the period from March to June 2022 were 75 percent higher than in the same period in the year before. Second, rising commodity prices were passed on to consumers, leading to higher domestic inflation. For instance, in June 2022 transportation sector prices were 26 percent higher than one year earlier.

**The authorities responded to the import surge through quantity-based measures and a more hawkish monetary policy stance.**

The Nepali Rupee has been pegged to the Indian Rupee at a constant rate since 1993. Although the peg provides stability to domestic import-dependent businesses and investors and anchors expectations, it also eliminates a key pricing mechanism as its inability to depreciate during the post-covid import boom likely delayed a rebalancing of foreign currency demand and supply. In the absence of price mechanisms, the policy response included an import ban for multiple product categories in April 2022, which is set to expire in October 2022. In addition to the ban, the authorities issued regulations that require importers of 47 product groups to deposit 50 to 100 percent of the imports' value in bank accounts to obtain a letter of credit prior to import. The authorities have also urged banks to limit the issuance of letter of credits for imports and have publicly advocated for stronger import substitution policies. In addition, the NRB has raised the policy

<sup>1</sup> Constraints to domestic growth include high transport costs due to a challenging topography, large infrastructure gaps, a difficult domestic business environment, and concentrated trade markets.

<sup>2</sup> <https://www.imf.org/-/media/Files/Publications/CR/2022/English/1NPLEA2022001.ashx>

**Fiscal policy has remained restrained throughout FY22.**

rate three times - in August 2021, February 2022, and July 2022 - to reduce credit and import demand.

Low budget execution rates and reduced intergovernmental transfers have kept the deficit in check, but structural problems remain unaddressed. Nepal's federal fiscal deficit stood at 3.5 percent of GDP at the end of FY22, continuing a three-year decline after a peak of 5.4 percent of GDP in FY20. The reduction in the fiscal deficit was driven by a 0.8 percentage point of GDP reduction of expenditure, as Nepal spent less on intergovernmental transfers and only executed 57 percent of its capital budget. While total government spending decreased, spending net of intergovernmental transfers increased, highlighting that the federal government did not reduce its expenditure envelope to align with its reduced scope of responsibility after the transition to federalism. Revenue increased by 0.2 percentage points of GDP in FY22 due to an expansion of excise revenue. By contrast, collections from less distortionary revenue sources, including income taxes and VAT, stagnated or declined. The revenue mix thus continues to be tilted towards production inefficient sources. Import duty revenues also declined, partially due to the impact of import bans since April 2022. Public debt stood at 41.5 percent of GDP at the end of FY22 and is split approximately evenly between external concessional and domestic sources.

**Growth is expected to decelerate modestly as fiscal and monetary policy normalizes.**

## OUTLOOK, RISKS, AND CHALLENGES

The forecast projects growth moderating to 5.1 percent in FY23 and 4.9 percent in FY24, reflecting monetary policy normalization, the end of pandemic-era monetary support measures, and still relatively high commodity prices. A rebound in tourism is projected to support the services sector, although higher interest rates could weigh on demand in other sub-sectors. Industrial growth is expected to be strong due to increased hydroelectricity production and an increased supply of electricity to other industrial sectors. Continued fertilizer shortages would weigh on agricultural growth. Inflation is expected to moderate to 5.3 percent in FY24 as commodity prices stabilize and a hawkish monetary policy is fully implemented.

**Public finances are expected to remain stable.**

The fiscal deficit is projected to fall from 3.4 percent of GDP in FY23 to 2.4 percent in FY24 as remaining COVID-19 support measures and FY23 electoral spending end, and the government implements revenue-enhancing reforms. Total public debt is projected to decrease to 40.7 percent of GDP by FY24.

**External pressure is expected to ease.**

The current account deficit is expected to narrow to 8.8 percent of GDP in FY23 and 5.7 percent in FY24 as tightened monetary policy increases import financing costs and commodity prices stabilize. Remittances are expected to increase by 0.7 percent of GDP between 2022 to 2024 reflecting increased outmigration and exports, while small in magnitude, are projected to rise. FDI is projected to remain low, leaving external borrowing and reserves drawdowns to continue financing the current account deficit.

**Risks to the outlook are balanced.**

Higher than expected inflation would reduce household purchasing power and drag growth, as would an extension of import restrictions. Welfare recovery remains uncertain due to rising inflation and risks to agricultural production. While a steeper drop in commodity prices would reduce the import bill and ease external pressures, a strong correction in oil prices could lower the demand for migrants in Gulf countries and weigh on remittances inflows.

## PART 2: SPECIAL FOCUS

### THE MACROECONOMIC IMPACTS OF CLIMATE CHANGE IN NEPAL

**Climate change is visibly impacting Nepal.**

**Projections of the impact of climate change on Nepal's development trajectory are provided using a macro-climate model.**

**Negative impacts are expected to accelerate sharply in the second half of the century, with GDP contracting 24 percent relative to the baseline by 2100.**

Nepal ranks as the 10th most affected country in the world according to the Climate Risk Index. The number of flood events has doubled in recent years; storms, erosion, and landslides are also on the rise, resulting in loss of life and livelihoods. Heavy monsoon floods and landslides in 2020 caused hundreds of deaths, displaced thousands of people, and damaged many roads. Mountains are warming faster than the plains, triggering melting of ice and permafrost and an increase in the risk of landslides. Incidences of dry spells, droughts, forest fires, heatwaves, flash floods, and disease outbreaks are increasing along with slow-onset risk. Past growth in the country has come at a high cost to the environment and health, and the current economic model needs to change to achieve green, resilient, and inclusive development (GRID).

Many international estimates of the impact of climate change on economic growth are cross-country, making it difficult to gauge the probable impact on any one country. The core of this analysis through 2050, calibrated to the Nepali economy, can be found in the World Bank Nepal Country Climate and Development Report, released in September 2022.

The discussion provided in this special focus section covers several—but not all—of the probable channels of transmission of climate impacts on the macroeconomy, the relative magnitude of the projected impacts, and expands the previous analysis provided in the Country Climate and Development Report (CCDR) through 2100.

The projection of climate impacts resulting in a GDP contraction of 24 percent by 2100 is relative to the baseline projection under the most pessimistic warming scenario, through three channels of transmission.

By 2100, the estimated impact of rising temperatures on labor productivity is projected to reduce GDP by 4.9 percent, the estimated impact of rising temperatures on agricultural activities is projected to reduce GDP by 8.3 percent, and the estimated impact of flooding on infrastructure is projected to reduce GDP by 12.9 percent. Combined, these impacts will not only reduce the size of the economy but also lead to an increase in the public debt to GDP ratio of 5.4 percent by the end of the century.

Although rising temperatures reducing labor productivity is projected to have the smallest impact on the macroeconomy, this is a partial estimation as the compound impacts of heat, disease, migration, and other related impacts on labor productivity are not modeled. The projected impact on agriculture only considers the negative effect of heat on agricultural yields and does not take into account rising risks from pests and other associated developments. Of the three climate shocks projected in the model for Nepal, flood damage on infrastructure is projected to have the largest impact on the macroeconomy. By damaging infrastructure such as roads and buildings, flooding is projected to reduce the capital stock, potential output, and production.

A list of 32 actionable steps that Nepal can take now to reduce these impacts and reinforce its Green, Resilient, and Inclusive Development (GRID) pathway is provided in the complete Country Climate and Development Report, available on the World Bank Open Knowledge Repository.<sup>3</sup>

**Table 1.** Near-term Policy Options to Support Nepal's Sustainable Growth Post-Pandemic

Sector	Recommendation
Fiscal	<p><b>Strengthening domestic tax revenue at the federal level.</b> A tax reform priority involves removing VAT exemptions to strengthen domestic revenue and enhance economic efficiency by allowing the country to replace distortionary excise and custom duties with the more efficient taxation of value added.</p> 
Federalism	<p><b>Full transition of spending responsibilities to subnational governments, and support to own-source revenue generation.</b> While Nepal currently devolves about 40 percent of all resources to provincial and local governments, their ability to independently allocate spending is limited. Alleviating these transition challenges requires continued efforts to reduce federally imposed spending restrictions on grants, increase the transparency of grant allocations, and provide targeted support to build subnational tax capacity.</p> 
Trade	<p><b>Remove remaining import restrictions and bans.</b> Nepal must actively manage import demand through restrained monetary and fiscal policy, raising interest rates when needed, substantially scaling back refinancing facilities, reinstating banks' regulatory provisions, and ensuring that fiscal spending does not excessively stimulate external demand.</p> 
Growth	<p><b>Improve the domestic electricity market to ensure that the development of green, bankable, least-cost generation is developed.</b> This requires (a) an agreed least-cost expansion plan; (b) cost- and quality-based, rationalized award of generation license issuance; (c) a fair platform for electricity trade within Nepal; and (d) adoption of best practices such as open grid access.<sup>4</sup></p> 
External and Growth	<p><b>Further develop hydropower in Nepal and Bhutan as the backbone of Bangladesh-Bhutan-India-Nepal trade.</b> To move forward, this requires (a) further elaboration of a trade framework to provide for the stable environment that energy investments need and (b) furthering of jointly developed regional cooperation agreements focused on enabling joint green growth to provide market stability and credible offtake agreements.<sup>5</sup></p> 

<sup>4</sup> Recommendation provided in Policy Package 2: Harnessing the Hydropower Opportunity and Energy Transition of the Nepal Country Climate and Development Report.

<sup>5</sup> Recommendation provided in Policy Package 2: Harnessing the Hydropower Opportunity and Energy Transition of the Nepal Country Climate and Development Report.

Sector	Recommendation
<b>External and Investment</b>	<p><b>Attracting additional sources of external financing, especially FDI.</b> FDI is the lowest in the region at 0.5 percent of GDP and can be increased through the easing of regulatory approval procedures, which would generate foreign currency inflows and stimulate growth through capital and technology transfers. Efforts to enable digital service exports by reforming Nepal's outdated telecommunications framework are an additional important avenue.</p> <p><b>The government can initiate fiscal reforms that make climate-smart investments more attractive.</b> This includes more effective targeting of subsidies for LPG and fertilizers and proper pricing policies for SOEs, especially public utilities. In addition, the removal of barriers to private investment would attract investment flows.</p>



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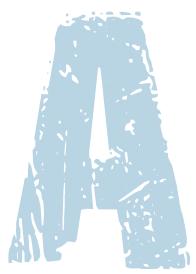
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# RECENT ECONOMIC DEVELOPMENTS



# RECENT ECONOMIC DEVELOPMENTS

## A.1 REAL SECTOR

### NEPAL EXPERIENCED A DEMAND-LED RECOVERY FROM THE PANDEMIC IN FY22

Growth continued to accelerate in FY22, marking a strong recovery from the pandemic-induced recession. Movement restrictions in combination with an almost complete shut-down of tourism during the COVID-19 pandemic resulted in Nepal's first economic contraction in almost 40 years in FY20 (-2.4 percent). A decisive vaccine roll-out and the reopening of borders have supported the economy's recovery since then, with growth inching up to 4.2 percent in FY21 and a further acceleration to 5.8 percent in FY22.



**Underlying the recovery was a rapid acceleration of domestic demand for consumption and investment goods and services.** Private consumption expenditure expanded by 5.4 percent in FY22, an acceleration of 1.1 percentage points compared to the previous years' growth rate (Figure 1). Similarly, private investment expenditure increased by 8.8 percent in FY22, 3.2 percentage points more than in FY21. Private demand benefited from pent-up savings accumulated during the pandemic and continued loose monetary policy (see discussion in monetary section). Consumption by the public sector also grew by a rapid 5.5 percent in FY22 due to an increase in civil servant salaries, one-off spending on local elections, and public spending on pandemic containment measures including vaccines. By contrast, public investment contracted by 6 percent in FY22 due to an inability to fully execute the capital budget (see discussion in fiscal section).

**Consumption demand primarily benefited the service sector.** The service sector grew by 5.9 percent in FY22, which is higher than the FY21 and close to the FY12-19 pre-pandemic average annual growth rate (Figure 2). Within the sector, especially wholesale and retail trade benefited from increased demand (Figure 3). Sub-sectors that had been impacted by the pandemic, including transportation and accommodation services, also picked up as domestic and international air passenger numbers increased, and international tourist started to arrive again. Higher demand and the availability of credit also drove a 41.6 percent increase in home sales, which benefited real estate services.

**The industrial sector benefited from higher investment rates.** In FY22, the sector grew by 10.2 percent, accelerating from a growth rate of 4.5 percent in FY21. This expansion was accompanied by a 52.2 percent growth in the number of new businesses registered (Figure 6) and a substantial credit expansion focused on investment (Figure 5). The hydropower sub-sector was the main driver of industrial sector growth, as an historically high 738.6 MW of additional capacity was added to the national grid, including 456 MW from the Upper Tamakoshi Hydropower Project (Figure 4).

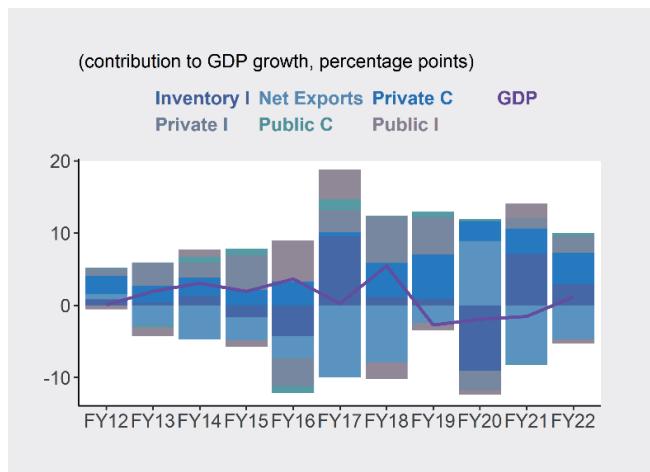
**Agricultural growth remained steady and did not benefit from the demand expansion.** Agriculture growth decelerated from 2.8 percent in FY21 to 2.3 percent in FY22, reflecting a fall in main season paddy production following unseasonal rains in October 2021. The slowdown occurred

despite an increase in public subsidies for chemical fertilizers and agricultural credits, which expanded from 0.4 percent of GDP in FY21 to 0.5 percent of GDP in FY22.

**Many of the additional goods demanded were imported.** Real import demand grew by 15 percent in FY22, and Nepal imported 4.8 percentage points of GDP more than in FY21. While the imported goods were instrumental in driving growth, Nepal's reliance on imports to meet domestic demand does, however, also mean that many of the economic benefits of higher demand and loose monetary policy were not accrued domestically and instead spilled over to import-supplying economies. At the same time, Nepal's export levels remain comparatively low, with exports standing at 6.9 percent of GDP at the end of FY22.

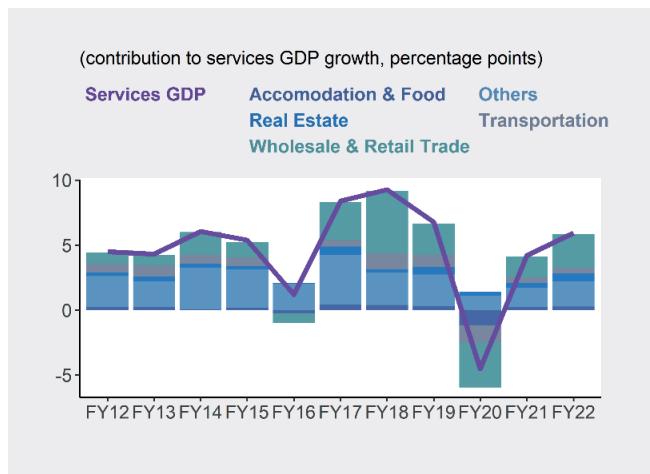
**An uneven and slow jobs recovery poses risks to poverty reduction and can exacerbate existing inequalities.** New analysis based on the second round of the SAR COVID-19 phone monitoring survey conducted at the end of 2021 suggests that the economic contraction induced by the pandemic had continued impacts on the labor market, with 22 percent of jobs lost during 2020 still not being recovered at the end of 2021. The recovery was however much faster in 2021 than it was by the end of 2020, when only 14 percent of those who lost their job reported having found a new one. The recovery from earnings losses has however been slower: 48 percent of respondents continued to report lower earnings in their latest jobs compared to their pre-pandemic earnings. Earning losses were also larger for those who reported a job loss, with 53 percent reporting an earnings loss relative to 45 percent for those who did not lose a job. The recovery was also uneven across demographic groups: (i) Women recovered 69 percent of the job losses while men recovered 83 percent, widening the pre-pandemic gender gap in employment; (ii) Older cohorts recovered slower than younger ones (72 percent of over 45 year-olds compared to 83 percent of 26-35 year-olds); (iii) and service sector employees recovered jobs faster (84 percent) than manufacturing (76 percent) and agricultural workers (65 percent). Elementary workers were also less likely to recover jobs than other occupations (73 percent versus 81 percent). Furthermore, continued inflation will increase the cost of basic needs, which will adversely impact the poor and vulnerable, although this may be partially mitigated by rising remittances.

**Figure 1.** Growth was driven by increasing demand for consumption and investment goods and services...



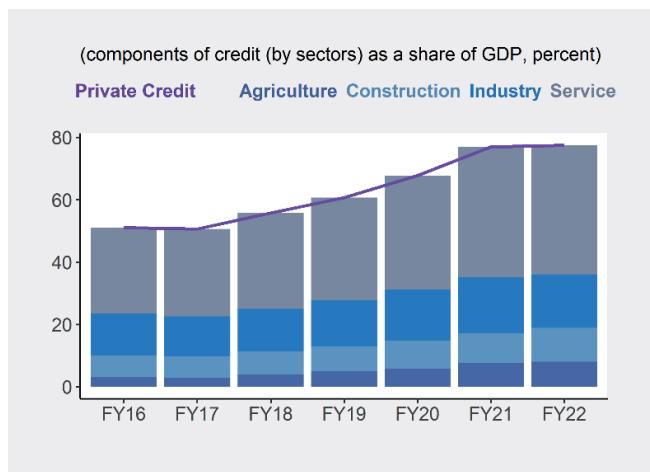
Sources: Central Bureau of Statistics and World Bank staff calculations.

**Figure 3.** Service sector growth was driven by higher consumption supplied by wholesale and retail traders...



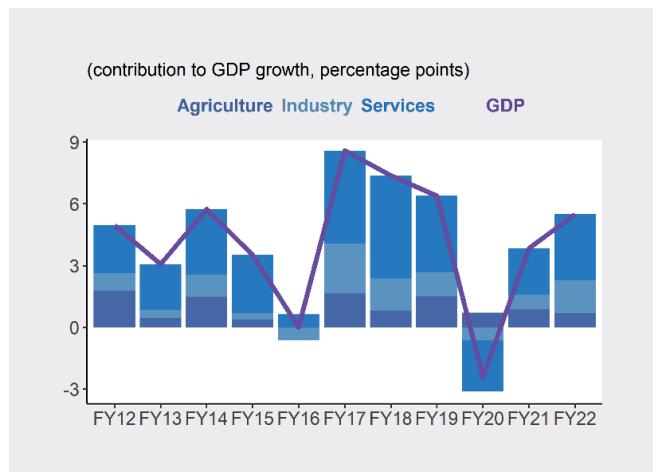
Sources: Central Bureau of Statistics and World Bank staff calculations.

**Figure 5.** ...and a credit expansion...



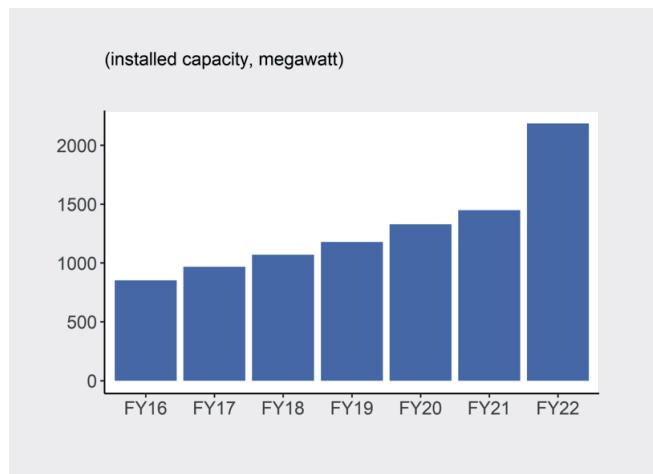
Sources: Nepal Rastra Bank and World Bank staff calculations.

**Figure 2.** ...which benefited the industrial and service sectors.



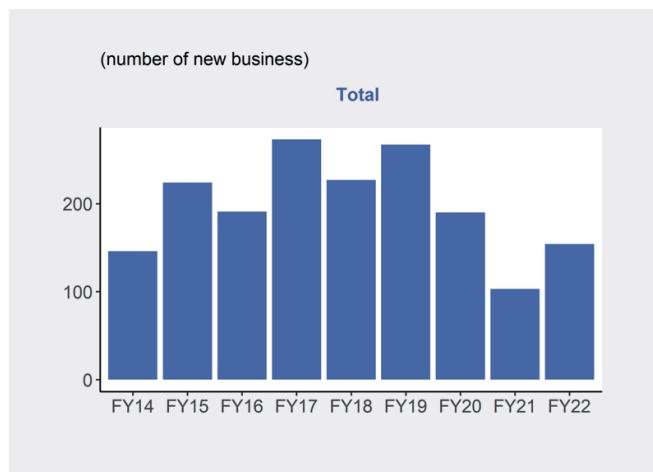
Sources: Central Bureau of Statistics and World Bank staff calculations.

**Figure 4.** ...whereas the industrial sector benefited from historic hydropower investments...



Sources: Nepal Electricity Authority and World Bank staff calculations.

**Figure 6.** ...that resulted in an increase in newly opened businesses.



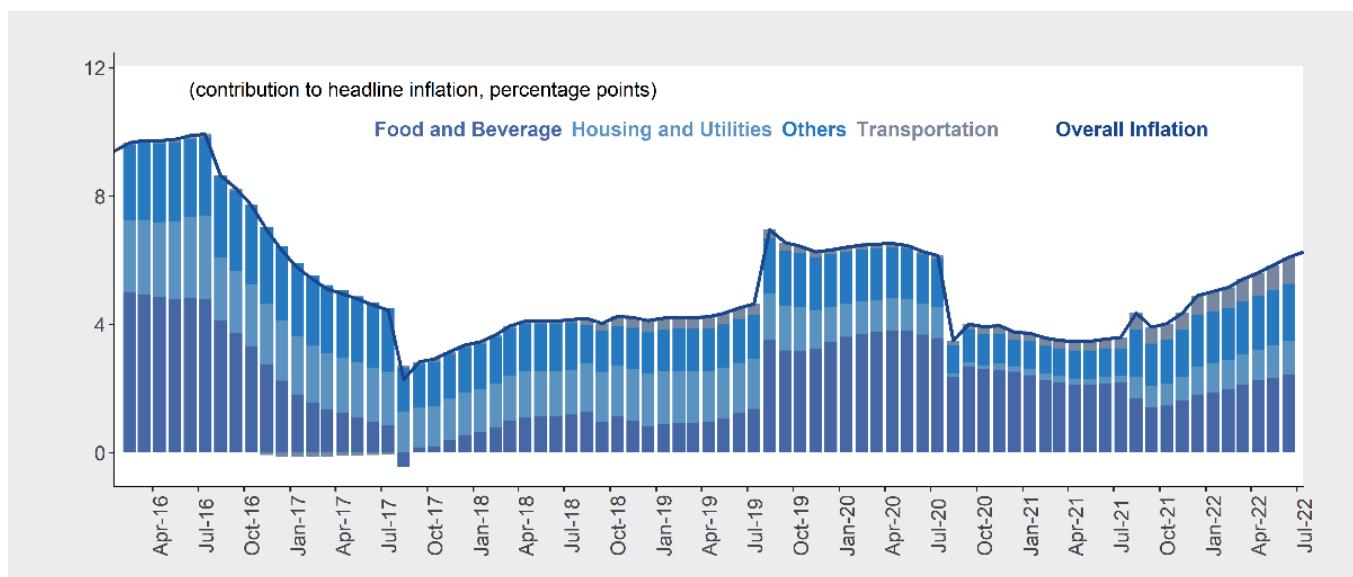
Sources: Department of Industry and World Bank staff calculations.

## INFLATION HAS CONTINUED TO RISE, DRIVEN BY BOTH DOMESTIC AND EXTERNAL FACTORS

**Average consumer inflation accelerated in FY22, buoyed by non-food and services inflation.** Average consumer prices rose at pace of 6.3 percent in FY22, compared with 3.6 percent in FY21, and remained close to the central bank's ceiling of 6.5 percent (Figure 7). Food price inflation edged up slightly by 0.6 percentage points to 5.6 percent in FY22, mainly due to edible oil prices which rose in FY21 and continued to increase further in FY22, owing to the war in Ukraine. At the same time, high global fuel prices were passed on to consumers and pushed

up transportation prices: in FY22, transportation sector prices grew by 16.1 percent, the highest rate in more than a decade, thereby making it one of the key contributors to inflation even though its weight in the CPI basket is only 5.3 percent (Figure 7). In addition, continued loose monetary policy and high domestic demand, especially early in FY22, exerted upward pressure on education fees and housing prices. As a result of these factors, non-food inflation accelerated to 6.7 percent, the highest rate since FY16.

**Figure 7.** Inflation continued to accelerate driven by transportation, edible oil and housing prices.



Sources: Nepal Rastra Bank and World Bank staff calculations.

## A.2 EXTERNAL SECTOR

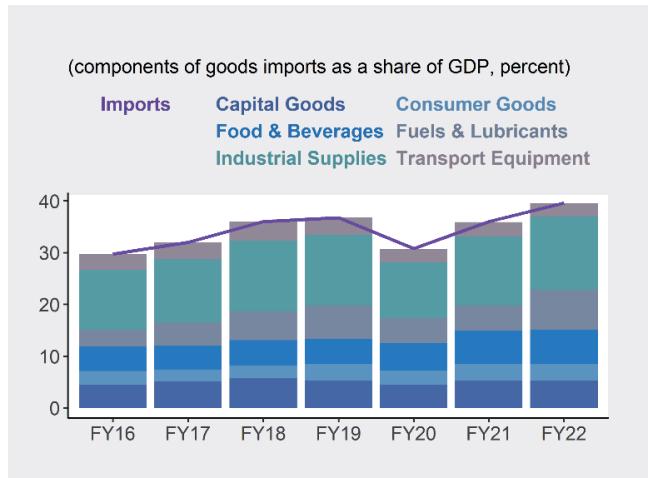
### RAPID DEMAND GROWTH AND RISING PRICES HAVE RESULTED IN AN IMPORT BOOM, WHICH HAS PUT PRESSURE ON FOREIGN EXCHANGE RESERVES

**The rapid increase in domestic demand and commodity price increases have fueled imports, which reached a record high in FY22.** The strong demand-led economic recovery after COVID-19 was accompanied by a surge in imports, which peaked in late 2021 and has moderated since then (Figure 9). At the end of FY22, total imports of goods and services stood at 43.4 percent of GDP, 4.8 percentage points

more than in the year prior (Figure 8). Import growth was driven by expansionary monetary policy (see discussion in monetary section), the import of COVID-19 vaccines, rising commodity prices following the Russian invasion of Ukraine<sup>6</sup>, and a 1.7 percent real effective exchange rate appreciation of the Nepali Rupee.

<sup>6</sup> Total fuel and lubricant imports for the period from March to June 2022 were 75 percent higher than in the same period in the year before.

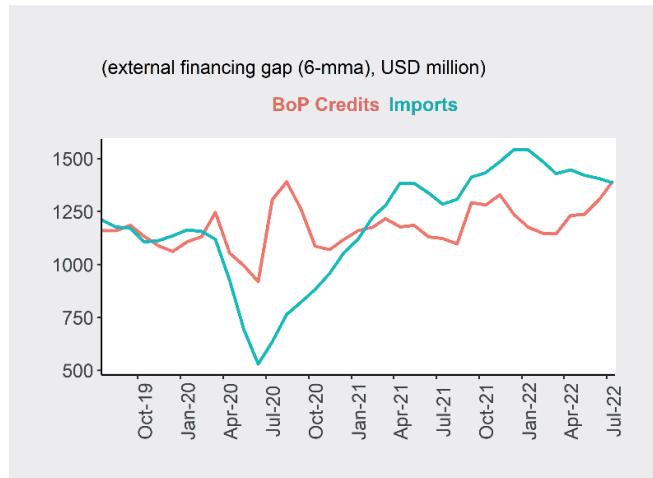
**Figure 8.** Imports of goods and services reached a record high in FY22 ...



Sources: Department of Customs and World Bank staff calculations.

**Imports have recovered much faster from the pandemic than Nepal's external financing sources.** In contrast to imports, remittances, Nepal's traditional source of foreign exchange earnings, have not grown substantially during the pandemic due to restrictions on international travel and have only begun accelerating since March 2022 (Figure 10).<sup>7</sup> At the end of FY22 remittances stood at 20.8 percent of GDP, a 1.7 percentage points decrease compared to FY21 and the lowest level since FY12. Service export earnings have also only started growing more recently, as the country reopens for tourism, and have increased by only 0.7 percentage point of GDP to 2.5 percent of GDP in FY22. Tourism arrivals and services exports remained below pre-pandemic levels largely owing to the slow recovery in tourist arrivals from China. By contrast, merchandise exports jumped from 3.4 percent of GDP in FY21 to 4.4 percent of GDP in FY22, underpinned primarily by the resumption of exports of palm oil to India from July 2021. Tariff exemptions on Nepali exports to India under the SAFTA agreement give Nepali traders an advantage, as palm oil producing countries face much higher tariffs on palm oil sales to the Indian market. Periodic palm oil export bans in producing countries and import bans in India lead to frequent interruption of Nepali palm oil exports.<sup>8</sup>

**Figure 9.** ...which resulted in the opening of an external financing gap.



Sources: Nepal Rastra Bank and World Bank staff calculations.

Note: BoP Credits include exports, investment income, transfer income, FDI, and liability-generating flows (net)

**With imports outpacing both exports and remittances, the trade and current account deficits widened.** The trade deficit widened by 3.1 percentage points to 36.5 percent of GDP and the current account deficit widened by 5 percentage points to 12.8 percent of GDP, the highest reading since record-keeping began in FY75.

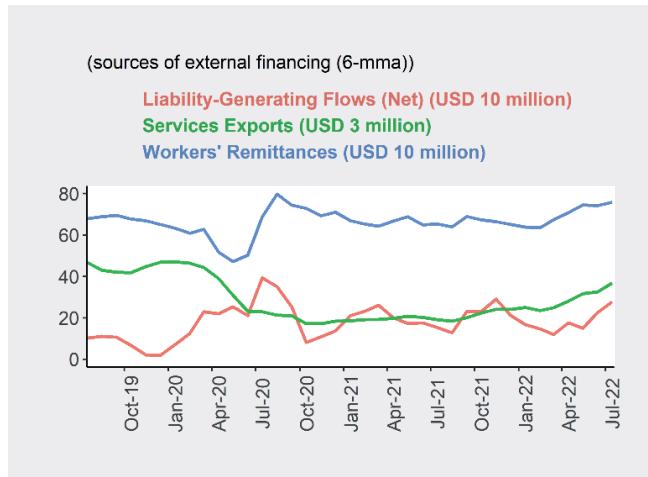
**Nepal drew down on foreign exchange reserves to finance the growing external deficits.** At the beginning of the pandemic Nepal accumulated a substantial buffer of foreign exchange reserves, due to both a slump in imports and new concessional loan disbursements. As imports outpaced foreign currency earnings during the recovery phase (Figure 9), Nepal used its reserves to finance imports, chipping away at the reserves stock until it was once again at pre-pandemic levels (Figure 11). Now that remittances and service exports are rising and the import boom abating, reserves are beginning to stabilize. Nepal's foreign exchange buffers are deemed adequate, with gross reserves covering 6.9 months of imports in mid-July 2022 and standing at USD 9.5 billion, the same level as in mid-July 2019. This is above the optimal level of 5.5 months recommended by the IMF<sup>9</sup>, and close to the central bank policy floor of 7 months of import cover.

<sup>7</sup> It is also possible that an easing of travel restrictions during FY22 has allowed for an increased use of informal channels to transfer remittances, which would result in an underestimation of their recovery in official statistics.

<sup>8</sup> Nepali businesses import crude palm oil from Malaysia, Indonesia, and other producing countries, which is then processed within Nepal and exported to India. Indonesia, the world's biggest producer and exporter of palm oil, periodically halts palm oil exports to control domestic prices. India periodically introduces bans on refined palm oil imports to protect its local refining industry.

<sup>9</sup> <https://www.imf.org/-/media/Files/Publications/CR/2022/English/1NPLEA2022001.ashx>

**Figure 10.** The financing gap arose because remittances and tourism exports began recovering after imports...



Sources: Nepal Rastra Bank and World Bank staff calculations.

**Figure 11.** ...and was financed by drawing down foreign exchange reserves accumulated early in the pandemic.



Sources: Nepal Rastra Bank and World Bank staff calculations.

## EFFECTIVE EXTERNAL MANAGEMENT IS CRITICAL TO MITIGATE RISKS OF STRUCTURAL IMBALANCES

**Nepal has a fixed exchange rate with India which disables pricing mechanisms that would otherwise have moderated the imbalance between imports and their financing sources.** The Nepali Rupee has been pegged to the Indian Rupee at a constant rate since 1993. The peg provides stability to domestic import-dependent businesses and investors and anchors expectations which, among others, moderates inflationary pressure. At the same time, the fixed exchange rate eliminates a key pricing mechanism as its inability to depreciate during the post-covid import boom likely delayed a rebalancing of foreign currency demand and supply.

**In the absence of price mechanisms, the authorities have adopted an unorthodox approach to alleviating external tensions.** The policy response involved the institution of an import ban for 10 product categories in April 2022. Banned products include high value mobile phones, passenger vehicles and motorcycles, and jointly account for about 4 percent of total imports. While the import ban was initially set to expire in July 2022, it has recently been extended through October 2022, albeit for a reduced list of products. In addition to the outright ban, the authorities have taken additional measures to throttle imports. These include the requirement for importers of 47 product groups to deposit

50 to 100 percent of the imports' value in bank accounts to obtain a letter of credit prior to import (see discussion in monetary section). The authorities have also urged banks to limit the issuance of letter of credits for imports and have publicly advocated for stronger import substitution policies.

**Quantity-based measures to restrict imports are unlikely to sustainably resolve external imbalances and will impact growth, inflation, and public finances.** Nepal's production capacity for many of the banned and restricted items is limited. As a result, import restrictions are likely to lead to shortages and rising prices for banned goods. In addition to the outright restriction of production or trading inputs, the requirement to pre-deposit cash into accounts prior to import can reduce firms' liquidity, which will also impact domestic production and growth. Finally, the banned items are subject to high import duties and in FY21 accounted for 5 percent of total fiscal revenue. The ban is thus also likely to reduce the government's revenue envelope.

**Instead, continued import demand management through interest rate policies and attracting additional sources of external financing, especially through FDI, will be critical.** As a landlocked country, Nepal's trade deficit is structural and unlikely to narrow materially in the medium-

term. External policy thus requires a two-pronged approach. First, Nepal must actively manage import demand through restrained monetary (and fiscal) policy, expanding upon the monetary measures already taken (see discussion in monetary section). Second, the attraction of additional and new external financing sources is key. To date, remittances, service exports

and concessional loans have provided reliable inflows. These can be complemented by the attraction of FDI, currently the lowest in the region at 0.5 percent of GDP, through the easing of regulatory approval procedures, which would generate foreign currency inflows and stimulate growth through capital and technology transfers.

## A.3 MONETARY AND FINANCIAL SECTOR

### THE IMPORT BOOM WAS FINANCED BY LOOSE MONETARY POLICY THAT RESULTED IN A RAPID CREDIT EXPANSION

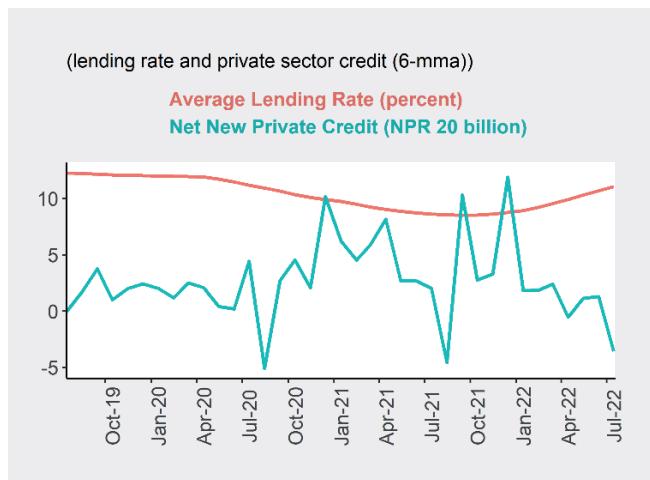
#### The central bank's Monetary Policy for FY22, published in August 2021<sup>10</sup>, anticipated a continued lagged recovery in several productive sectors of the economy.

Monetary policy at the start of FY22 was designed to balance support for the fledgling economic recovery with the tightening required for economic and financial stability. The inflation ceiling was set at 6.5 percent (0.5 percentage points below the previous year's ceiling), the policy floor of foreign exchange reserves covering 7 months of imports was maintained, and growth of broad money and credit

to the private sector were projected at 18 and 19 percent, respectively.

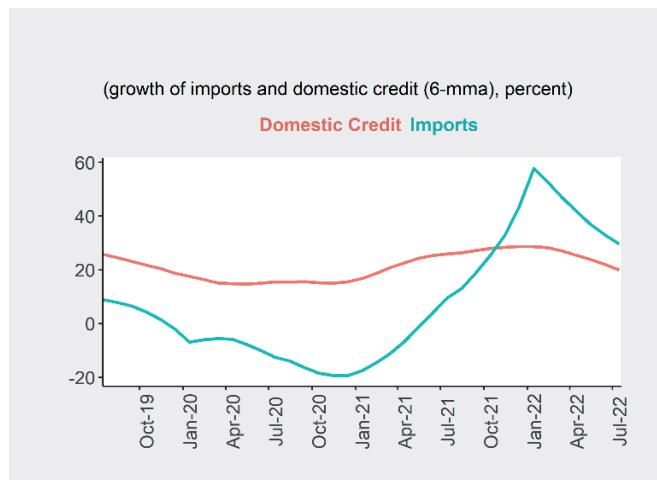
**Accommodative monetary policy led to credit growth, which in turn contributed to import growth with a lag.** More accommodative monetary policy in the second half of FY21 pushed down lending rates and led to a sharp rise in new loan issuances (Figure 12). The credit surge contributed to imports peaking in the first half of FY22 and continued downward pressure on foreign exchange reserves (Figure 13); also see discussion in external section).

**Figure 12.** As average lending rates declined in response to lower policy rates, credit rose sharply in the second half of FY21 ...



Sources: Nepal Rastra Bank and World Bank staff calculations.

**Figure 13.** ... contributing to strong import growth in the first half of FY22.



Sources: Nepal Rastra Bank and World Bank staff calculations.

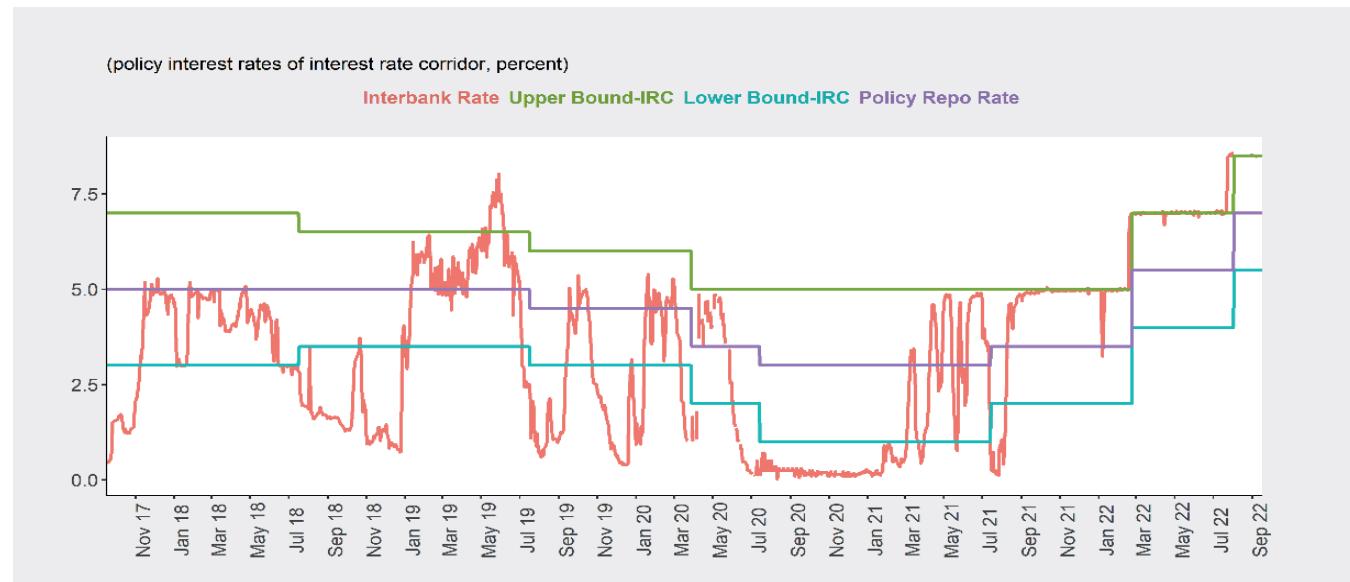
<sup>10</sup> Nepal Rastra Bank, August 13, 2021 "Monetary Policy for 2021/22 (unofficial translation)" delivered by Governor Mr. Maha Prasad Adhikari

## A PIVOT TOWARDS MORE RESTRICTIVE MONETARY POLICY – TARGETING BOTH CREDIT DEMAND AND SUPPLY – IN THE SECOND HALF OF FY22 AIMED TO CONTAIN EXTERNAL PRESSURE

**To reign in credit demand, the NRB raised its policy repo rate.** As credit growth surged beyond expectations in the first half of FY22, monetary policy pivoted to respond to concerns regarding higher than anticipated credit growth, the soaring import bill, declining reserves, and rising inflation. In February 2022 the policy repo rate was raised by 200 basis points which shifted the interest rate corridor upwards (Figure 14). A second hike on August 3, 2022 in line with the FY23 monetary policy increased the policy repo rate by a further 150 basis points, continuing the trend of monetary policy tightening.

**The interest rate policy was not the only factor cooling credit demand as three financial sector regulatory restrictions (intended to curb imports through reduced credit demand) were also applied during FY22.** Key regulatory provisions include (i) raising letter of credit and cash backing (cash margin) requirements on selected “non-essential goods”; (ii) introducing higher risk weights on trust receipt loans, personal overdraft loans, real estate loans relating to land plotting, and personal hire purchase loans for the purchase of vehicles; and (iii) increasing the risk weight of margin lending.<sup>11</sup>

**Figure 14.** To reduce demand for credit the NRB raised interest rates in February and July 2022.



Sources: Nepal Rastra Bank and World Bank staff calculations.

<sup>11</sup> Cash margin requirements were defined through central bank circulars in December 2021 and February 2022. A cash margin is a deposit held in the importers bank account. Trust receipt loans are loans provided to importers for the payment of imports made through letters of credit. Personal overdraft loans are loans provided to individuals to meet short-term obligations, while personal hire purchase loans are loans provided to individuals for the purchase of vehicles. Margin loans are loans against marketable securities listed in the organized stock exchange and are provided to individuals and firms.

## CONCURRENT WITH TIGHTER MONETARY POLICY DEPOSITS DECREASED AS HIGH INFLATION PUSHED DEPOSIT RATES INTO NEGATIVE TERRITORY

**The CD ratio became a binding constraint to lending as deposits shrank in FY22.** Deposits fell from 109.3 percent of GDP at the end of FY21 to 105 percent of GDP at the end of FY22 due to lower deposits by non-bank financial institutions and government and non-government corporations (Figure 18). These contracted by 7.1 percentage points of GDP during this period, due in part to the use of deposits by the Nepal Oil Corporation to import petroleum products at higher prices. Individual deposits expanded by 2.1 percentage points of GDP and were unable to compensate for the decline in institutional deposits.

**Deposit supply was constrained by a policy-induced inability of deposit rates to adjust to increased demand and rising inflation.** As real deposit rates turned negative in November 2021 (Figure 17), the incentives for households and firms to increase their deposits were reduced. In a liberalized market, when faced with a shortfall of loanable funds, banks would be expected to raise the deposit interest rates offered to the public to encourage them to increase their deposits. There are several mechanisms in the Nepalese banking sector that make this type of dynamic adjustment more difficult for deposit-taking institutions, including monthly caps on adjustments to interest rates that cannot exceed 10 percent of the previous month's rate.

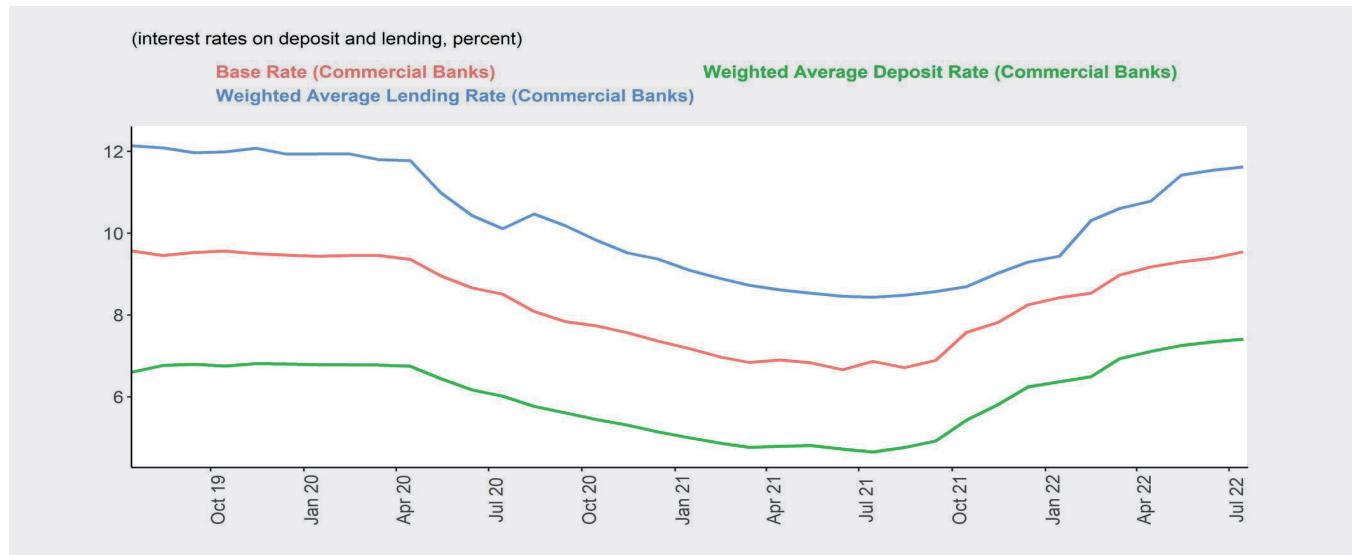
## THE INCREASE IN THE POLICY REPO RATE WAS INSUFFICIENT TO REDUCE CREDIT DEMAND, LEADING TO A JUXTAPOSITION BETWEEN CONTINUED HIGH LIQUIDITY DEMAND AND A REDUCTION OF LOANABLE FUNDS THAT RESULTED IN A CREDIT CRUNCH

**Continued high demand for credit resulted in high demand for liquidity by banks.** The impact of tightening monetary policy on credit demand has thus far been limited. Not only has the interbank rate closely followed the upper bound of the interest rate corridor since July 2021, but the volume of liquidity demand has also grown substantially and was not subdued with the interest rate hike in March 2022. The amount transacted in the standing liquidity facility (SLF) in FY22 was

more than twenty-fold the volume provided in FY21 despite the 200-basis point interest rate increase (Figure 19). As a result, much more liquidity has been provided by the central bank during FY22 than in previous years.

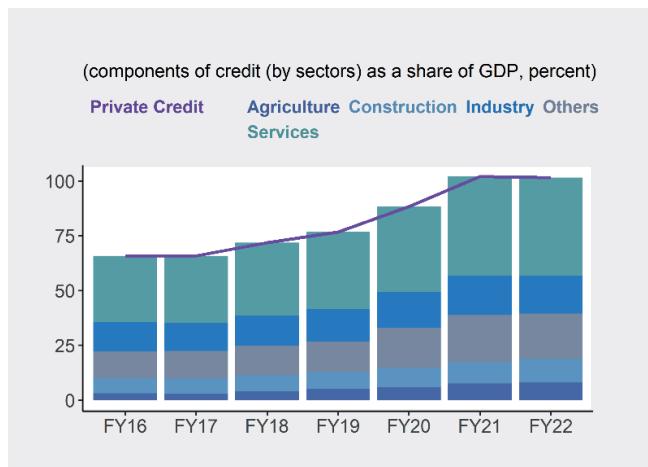
**The increased liquidity injections were insufficient to compensate for the reduction in loanable funds, resulting in a credit crunch.** The higher lending interest rates offered by

**Figure 15.** The lending rate increased with the higher interest rate on deposits.



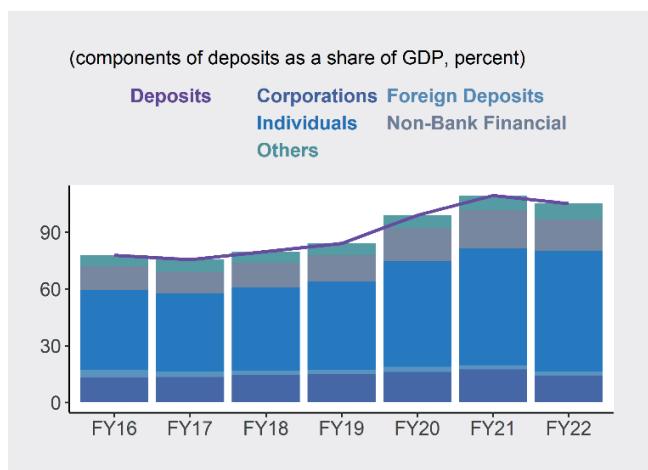
Sources: Nepal Rastra Bank and World Bank staff calculations.

**Figure 16.** Private sector credit surged midyear then stabilized during FY22.



Sources: Nepal Rastra Bank and World Bank staff calculations.

**Figure 18.** ...which reduced deposits...

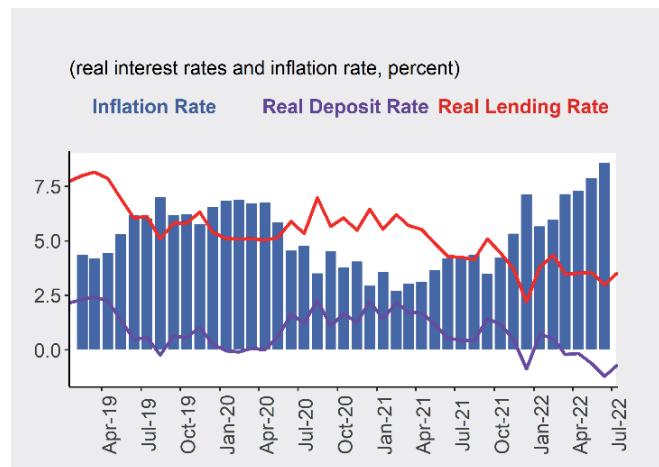


Sources: Nepal Rastra Bank and World Bank staff calculations.

commercial banks to borrowers, which rose from 8.5 percent to 11.6 percent from mid-July 2021 to mid-July 2022 (Figure 15), have contributed to cooling credit demand and, by the end of FY22, private sector credit had largely returned to FY21 levels as a share of GDP. Credit to the private sector fell from 102 percent of GDP at the end of FY21 to 101.5 percent of GDP at the end of FY22, thus stabilizing at relatively higher prices (Figure 16).

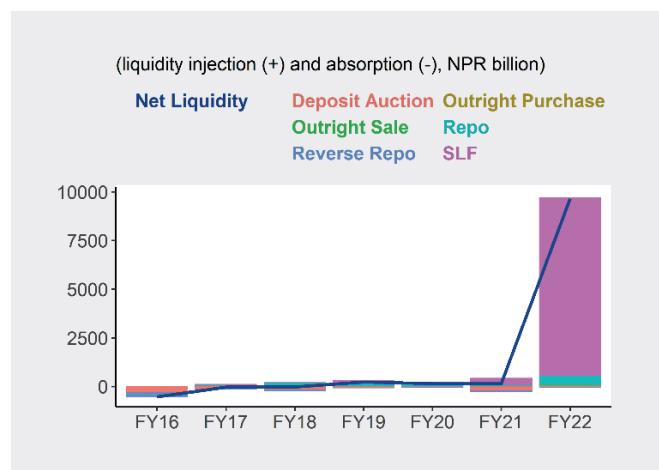
**Indicators of BFIs soundness remained strong despite liquidity constraints.** The average capital to risk-weighted assets ratio - a measure of bank capital adequacy - remained above the regulatory minimum of 11 percent. In addition,

**Figure 17.** The real interest rate fell throughout FY22 as inflation rose to multi-year heights...



Sources: Nepal Rastra Bank and World Bank staff calculations.

**Figure 19.** ...and resulted in continued high demand for liquidity injections.



Sources: Nepal Rastra Bank and World Bank staff calculations.

the total volume of non-performing loans of BFIs - loans that are overdue by 90 days or more - also declined marginally, driven by the extension of loan repayment schedules as part of the central bank's response to COVID-19. The ratio of nonperforming loans to total loans remained very low throughout the year, registering 1.3 percent for commercial banks, 1.5 percent for development banks, and 7 percent for finance companies in mid-July 2022. While these figures are reassuring, some continued forbearance measures<sup>12</sup> through the end of FY22 may mask actual asset quality in the banking sector until they are fully lifted.

<sup>12</sup> For example, the counter-cyclical buffer provision for financial institutions, which was suspended in FY20, will be reinstated in FY23.

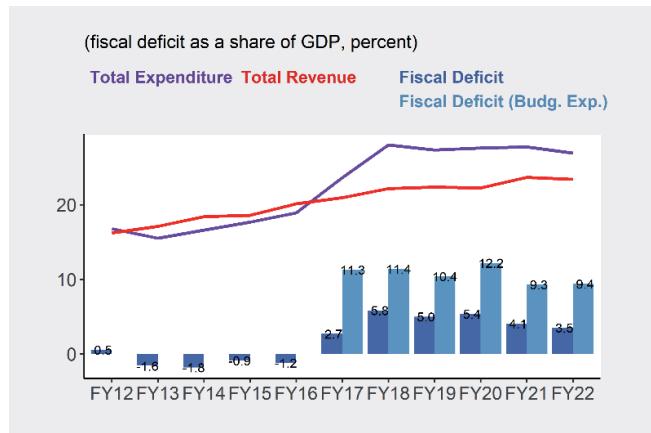
## A.4 FISCAL SECTOR

### IN CONTRAST TO MONETARY POLICY, FISCAL POLICY DID NOT PROVIDE AN EXCEPTIONAL DEMAND STIMULUS IN FY22

**Nepal's fiscal deficit narrowed in FY22.** The deficit stood at 3.5 percent of GDP and thus continues a three-year declining trend since the deficit peaked at 5.4 percent of GDP in FY20 (Figure 20). The reduction in the fiscal deficit was driven by reduced expenditure, which narrowed from 27.7 percent of GDP in FY21 to 26.9 percent of GDP in FY22, whereas revenues and grants declined marginally by 0.3 percentage points of GDP over the same period. This trend of fiscal consolidation

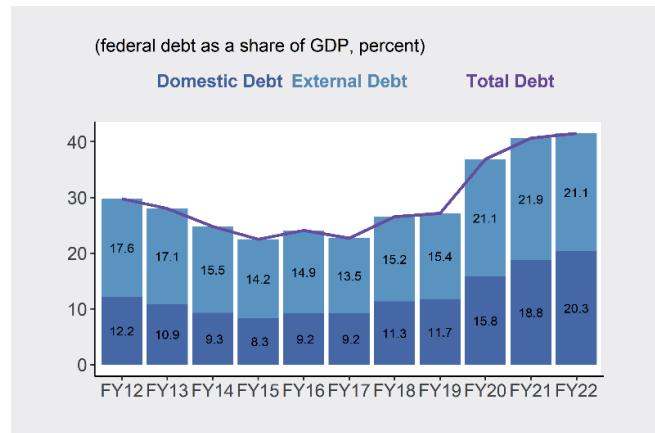
slowed the growth of Nepal's public debt stock, which only increased by 0.9 percentage points of GDP between FY21 and FY22 after almost doubling between FY17 and FY21 (Figure 21). Total public debt at the end of FY22 stood at 41.5 percent of GDP and is split equally between domestic and external sources, with all external public debt owed to multilateral or bilateral development partners on predominantly concessional terms (Table 2).

**Figure 20.** The fiscal deficit continued to narrow in FY22...



Sources: Ministry of Finance and World Bank staff calculations.

**Figure 21.** ...which resulted in a deceleration in the growth of the public debt stock.



Sources: FCGO and World Bank staff calculations.

**Table 2.** Stock of Public and Publicly Guaranteed (PPG) External and Domestic Debt (% of GDP)

	FY19	FY20	FY21	FY22
External	15.4	21.1	21.9	21.1
Multilateral	13.6	18.2	19.2	18.4
o/w World Bank	7.8	9.9	11.0	10.5
o/w ADB	5.3	6.9	6.9	6.5
o/w IMF	0.0	0.7	0.8	0.9
Bilateral	1.8	2.5	2.6	2.7
o/w Non-Paris Club	0.9	1.4	1.5	1.6
o/w China	0.5	0.7	0.7	0.7
o/w India	0.4	0.6	0.7	0.7
o/w Paris Club	1.0	1.1	1.1	1.1
Domestic	11.7	15.8	18.8	20.3
Treasury Bills	3.8	5.5	6.5	7.3
Development Bonds	7.7	10.0	12.0	12.8
Others	0.2	0.2	0.2	0.2
Total	27.2	36.9	40.62	41.5

Source: Central Bureau of Statistics for GDP, PDMO for debt, and Nepal Rastra Bank for the exchange rate.

## CONSOLIDATION WAS NOT THE RESULT OF A HOLISTIC REFORM STRATEGY

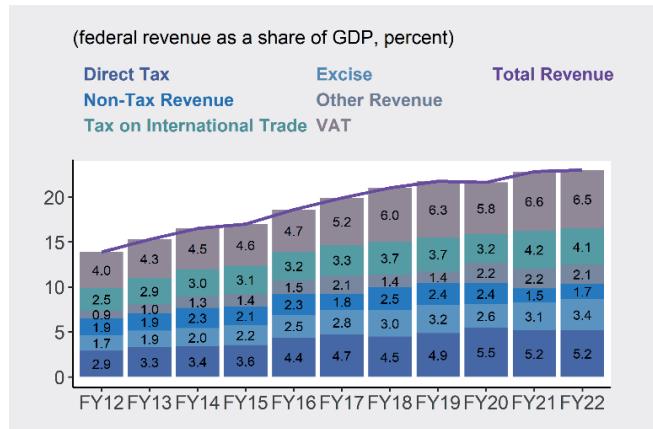
**In FY22, Nepal expanded excise taxes, whereas collections from more production-efficient sources stagnated.** Total revenue increased by 0.2 percentage points of GDP between FY21 and FY22, driven by a strong performance of production-based excise taxes that were buoyed by an increase in tax rates on select products in May 2022, and a 0.2 percentage points of GDP increase in non-tax revenue (Figure 22). By contrast, revenue from less distortionary taxes that target profits or value added, such as direct taxes or the VAT, stagnated or declined. Import duties also declined by 0.1 percentage points of GDP owing to the imposition of import restrictions through cash margin requirements from December 2021 and an outright import ban on select items from April 2022 (see discussion in external and monetary sections). The increase in excise collection balanced the revenue loss from VAT and import duties, leaving total tax collection constant at 20.3 percent of GDP between FY21 and FY22 but shifting the composition towards more production-distortionary sources.

**Expenditure rationalization was achieved through a reduction in intergovernmental transfers.** The authorities significantly increased federal expenditure after the transition to federalism in FY18, as the federal government started devolving resources through grants without a commensurate adjustment to its direct spending levels (Figure 23).<sup>13</sup> This pattern has not been rectified in FY22: while total spending by the federal level declined from 27.7 percent of GDP in FY21 to 26.9 percent of GDP in FY22, federal spending net of intergovernmental transfers increased by 0.3 percentage points of GDP. The expenditure consolidation was achieved through a 1.1 percentage point reduction in intergovernmental transfers, as subnational governments received lower conditional and equalization grant allocations (Figure 24).

**In addition to a reduction of intergovernmental transfers, an inability to execute budgets was the key driver of expenditure consolidation.** Had the authorities met all their budgeted expenditures, the fiscal deficit would have increased by 0.1 percentage points of GDP between FY21 and FY22 (Figure 20). Capital expenditure took the brunt of budget under-execution and declined by 0.9 percentage points of GDP.

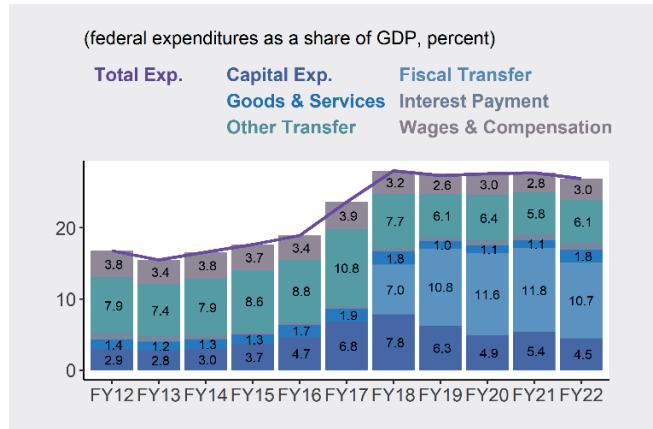
<sup>13</sup> Refer to the World Bank's 2021 Nepal Public Expenditure Review, entitled "Fiscal Policy for Sustainable Development", for an in-depth discussion.

**Figure 22.** An expansion of excise duties supported revenue collection...



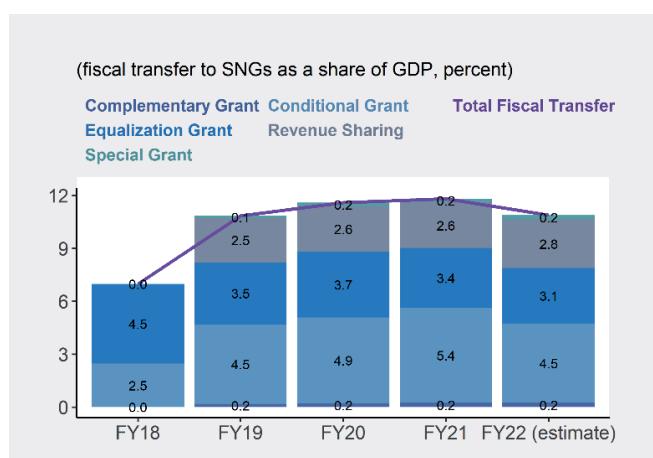
Sources: Ministry of Finance and World Bank staff calculations.

...and lower intergovernmental transfers and capital expenditure reduced expenditures.



Sources: Ministry of Finance and World Bank staff calculations

Intergovernmental grants were reduced across all types, whereas revenue sharing expanded modestly.

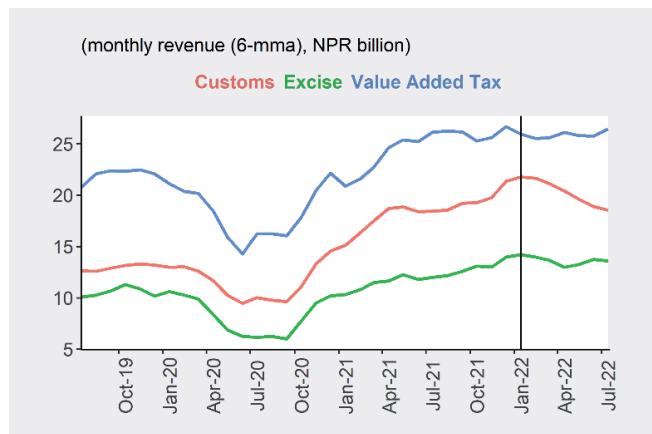


Sources: Ministry of Finance and World Bank staff calculations.

## STRUCTURAL CHALLENGES THAT CONSTRAIN EFFECTIVE FISCAL POLICY AND A FULL TRANSITION TO FEDERALISM REMAIN

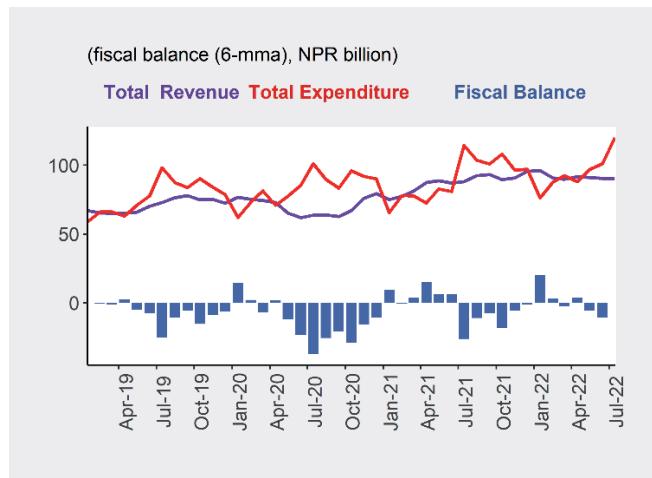
**Indirect revenue collection continued to be import-dependent and was adversely affected by measures imposed to protect foreign exchange reserves.** Nepal relies heavily on imports as a tax base, which contribute about half of total tax revenues through VAT, excise and import duties. While the taxation of imports has allowed Nepal to raise higher revenues than most other countries in the region, it has also generated a trade-off between external and fiscal policy. This became apparent in the second half of FY22, when the authorities issued various import control measures to ease pressure on foreign exchange reserves, including the requirement for importers of 47 product groups to deposit 50 to 100 percent of the imports' value in bank accounts to obtain a letter of credit prior to import (imposed in December 2021), and the outright ban on the import

**Figure 25.** Import control measures affected indirect taxes...



Sources: Nepal Rastra Bank and World Bank staff calculations.  
Note: Vertical bar indicates mid-January 2022.

**Figure 27.** ...leading to a cyclical fiscal balance throughout the year...

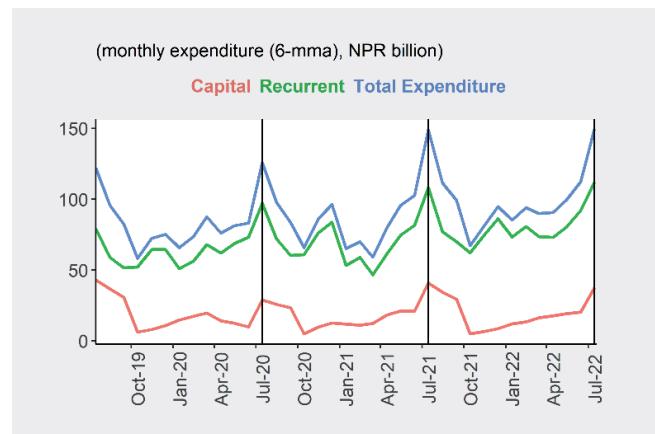


Sources: Nepal Rastra Bank, FCGO, and World Bank staff calculations.

of 10 product groups in April 2022. These measures adversely impacted customs revenue, which declined by 29.5 percent in nominal terms between December 2021 and May 2022, compared with a 9.4 percent increase over the same period in the year prior (Figure 25).

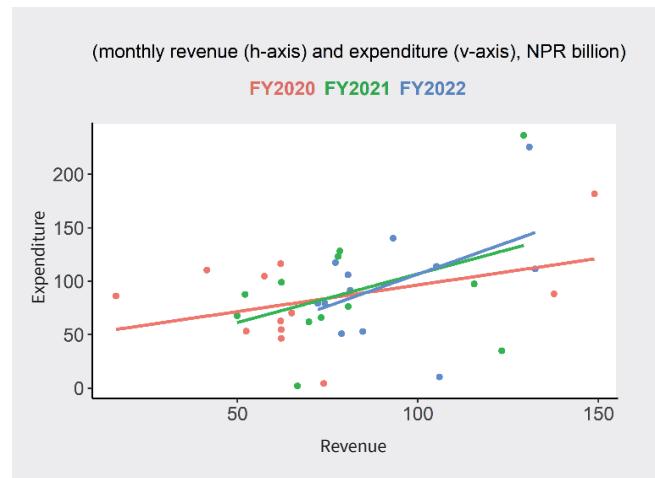
**Indirect revenue sources that have a lower share of import-dependence have proven more resilient.** While excise revenue also declined initially, it was buoyed by a sweeping increase in excise rates on alcoholic beverages and tobacco products, among others, that became effective in May 2022. Notably, VAT, which taxes consumption and not just imports, remained resilient to all import control measures, highlighting that a shift from import taxes towards VAT can not only enhance

**Figure 26.** ...and spending continues to be skewed heavily towards the end of the fiscal year...



Sources: FCGO and World Bank staff calculations.  
Note: Vertical bars indicate the end of fiscal years.

**Figure 28.** ...and driven by an increasing correlation between resource availability and expenditure.



Sources: Nepal Rastra Bank and World Bank staff calculations.

production efficiency but also moderate the trade-off between fiscal and external policy. End-of-year bunching of spending, especially for capital expenditure, persists. Nepal's government expenditure follows a cyclical pattern in which spending spikes just before the end of the fiscal year in July (Figure 26). In FY22, Nepal executed 30 percent of total spending in the last two months of the fiscal year, a similar share as in FY21. This was even more pronounced for capital expenditure, 45 percent of which was executed in June and July of 2022. By contrast, in August and September 2021, the first two months of the fiscal year, Nepal only executed 1.2 percent of total capital spending. Such bunching of spending has been associated with low execution rates and development impacts of capital spending<sup>14</sup>, and leads to a cyclical fiscal balance in which Nepal's budget remains balanced until only late in the fiscal year (Figure 27).

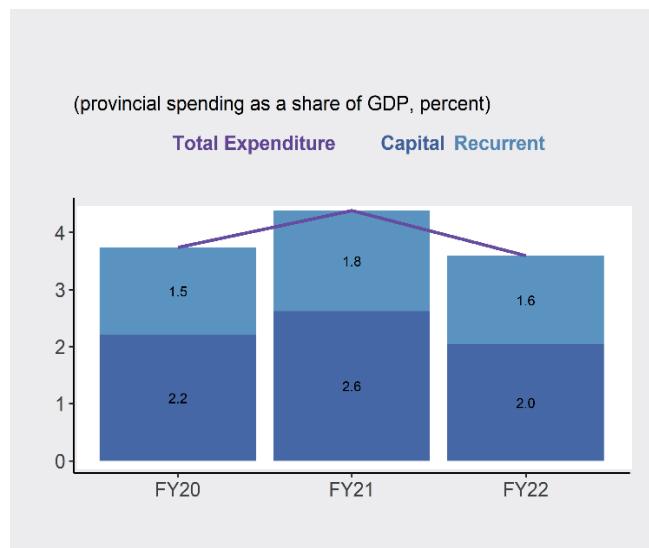
**There is evidence that delays in budget execution may be driven by liquidity constraints within the government.** The bunching of spending towards the end of the fiscal year is often explained by the delayed release of resources. Indeed, months in which Nepal collects higher revenue are also months in which expenditure increases (Figure 28). The magnitude of this correlation has increased in recent years, suggesting that cash constraints remain a critical driver of spending irregularities.

**A large share of subnational spending continues to be earmarked.** Nepal's intergovernmental transfer system distinguishes between resources that can be spent at the discretion of subnational governments, such as equalization grants and revenue sharing, and resources that are earmarked for specific sectors and projects, such as conditional grants. While conditional grants conceptually intend to complement subnational spending from untied resources, they have been used extensively during the federalism transition period with the intention to maintain service delivery while local and provincial governments become operational. In FY22, five years after intergovernmental transfers were first paid, conditional grants remain the most important grant used in Nepal, accounting for 4.5 percent of GDP in FY22 (Figure 24). Conditional grants are especially prevalent for transfers to local government, accounting for 3.6 percent of GDP in FY22 and financing over half of their spending. While conditional grant spending by the federal government has decreased on aggregate, this was driven by lower total allocations to transfers and lower conditional grant allocations for provinces.

**Provincial spending declined in FY22 as less than 60 percent of provincial budgets were spent.**<sup>15</sup> A further indication that progress in implementing fiscal federalism has been slow is that provincial spending has declined by 0.8 percentage

points of GDP between FY21 and FY22, driven primarily by a substantial reduction in provincial capital spending (Figure 29). This was driven by low budget execution rates that averaged only 57 percent for total and capital spending. Execution rates varied significantly between provinces and stood at 87 percent in the more industrialized province 1, and at only 36 percent in the more rural and low population density Karnali province (Figure 30).

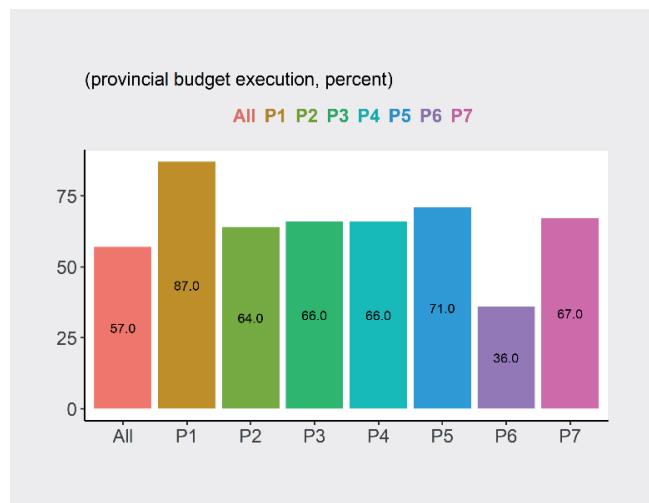
**Figure 29. Provincial spending declined in FY22...**



Sources: FCGO and World Bank staff calculations.

Note: This figure shows aggregate spending by provinces (in % of GDP).

**Figure 30. ...and was constrained by low budget execution rates.**



Sources: FCGO and World Bank staff calculations.

Note: This figure shows total budget execution rates for provinces, defined as actual spending as a share of budgeted spending.

<sup>14</sup> World Bank (2021). Nepal Public Expenditure Review: Fiscal Policy for Sustainable Development.

<sup>15</sup> Data for local-level actual spending in FY22 is not available.





# OUTLOOK, RISKS, AND CHALLENGES



# OUTLOOK, RISKS, AND CHALLENGES

**Under the baseline scenario, growth is expected to decelerate over the medium term as pandemic-era stimulus continues to be unwound.** The baseline scenario assumes that monetary policy continues to normalize, that COVID-19 related monetary and fiscal stimuli are unwound, and that global headwinds persist. These factors are expected to contribute to a gradual deceleration of growth to 5.1 percent in FY23, and to 4.9 percent in FY24 (Table 3). The growth outlook is bolstered by the assumption that ongoing import restrictions will end by October 2022, and that international tourist arrivals will reach pre-pandemic levels by FY24.



**A rebound in tourism is expected to support the service sector.** Apart from contact-based sectors (transportation and accommodation), output in all services sub-sectors had reached pre-pandemic levels by FY22. Tourism is expected to continue to recover, supported both by rising international demand and improvements to domestic infrastructure, such as the newly constructed Gautam Buddha International Airport and Pokhara Regional International Airport. The authorities' plan to dedicate the years 2023 to 2033 as the "Visit Nepal Decade" may also help attract tourists. Considering these factors, service sector growth is projected at 5.6 percent in FY23 and 5.1 percent in FY24.

**Industry sector growth is projected to remain high and drive aggregate growth.** A continued expansion of hydroelectricity production capacity is expected to drive industrial sector growth over the medium-term as Nepal attempts to achieve its target production of 6,500 MW by FY24, from the existing 2,190 MW. The associated increase in the supply of electricity to other industrial sub-sector and increased public capital spending are also envisioned to support industrial growth, leading to projected growth rates of 8.9 and 9.2 percent for the sector in FY23 and FY24, respectively.

Agricultural growth is expected decelerate modestly. While a good monsoon season during late 2022 and increases in the land area used for paddy plantations will support agricultural growth in FY23, a continued shortage of chemical fertilizers is expected to provide significant headwinds. The fertilizer shortage is expected to be partially mitigated by a five-year agreement signed between the governments of Nepal and India in February 2022, whereby India would supply a fixed quantity of chemical fertilizers to Nepal on an annual basis.

**Inflation is expected to moderate slightly in the medium term as commodity prices stabilize and monetary policy reigns in demand.** Inflation in FY23 is expected to fall to 5.5 percent and decelerate further to 5.2 percent in FY24. However, increases in aggregate demand due to national and provincial elections in November 2022, continued financial sector restrictions on the issuance of letters of credit for the import of select items, the export ban on the select food commodities (wheat, sugar, and broken rice) imposed by India, and a higher customs duty on the export of rice by India are likely to increase domestic prices, which means that inflation is expected to remain above 5 percent and above the pre-pandemic levels.

**Nepal's large trade deficit is expected to narrow gradually as import-driving stimuli are unwound.** Nepal's trade deficit is projected to narrow to 33 percent of GDP in FY23 and further to 30.4 percent of GDP in FY24. Merchandise imports are projected to decrease as global commodity prices normalize, import financing costs increase due to tighter domestic monetary policy, and electricity imports decline as the country becomes a net exporter of electricity from FY23 onwards. In addition, the addition of an approximate 4,000 MW of hydropower capacity over the medium-term is expected to lower the volume of crude oil imports as households, firms, and government offices can substitute towards electricity. Merchandise exports are expected to grow commensurate with industrial sector growth, benefiting from lower input cost as firms move to the use of hydropower electricity and buoyed by hydropower export potential to India and Bangladesh. Service trade is also projected to grow robustly as exports are buoyed by the projected recovery of the tourism sector.

**The current account deficit is projected to narrow, but external financing needs will remain elevated.** The current account deficit is expected to narrow to 8.8 percent of GDP in FY23 and 5.7 percent in FY24 as a projected growth of remittances adds to a narrowing trade deficit. Remittances are expected to increase by 0.7 percentage points per year in FY23 and FY24 and are expected to reach 21.5 percent of GDP by FY24, reflecting increased out migration during



FY22. Indeed, the number of international migrant workers, a closely watched proxy for future remittance inflows, rose by almost 400 percent in FY22 because of a resumption of migration to Kuwait, South Korea, and Malaysia and strong demand for migrant workers from other Gulf countries (Saudi Arabia, Qatar, Kuwait, and United Arab Emirates), helped by a relaxation in COVID-19 restrictions. The current account deficit is projected to remain financed by concessional borrowing, trade credits and, where necessary, drawdowns of foreign exchange reserves.

**The fiscal deficit is expected to narrow in the medium term.** The fiscal policy is projected to narrow slightly to 3.4 percent of GDP FY23 as the remaining fiscal COVID-19 support to households and firms ends, and as the November 2022 elections are expected to weigh on expenditure execution. The deficit is expected to narrow further to 2.4 percent of GDP in FY24 as measures to avoid duplication of spending among the three tiers of governments are implemented, and the government, with World Bank and IMF support, adopts

revenue-enhancing reforms. Capital spending is likely to improve in FY24 as public investment management reforms are implemented. The deficit is expected to be financed by external concessional and domestic borrowing. Total public debt is projected to reach 41.6 percent of GDP in FY23 and then decrease to 40.9 percent of GDP by FY24. Debt is expected to remain sustainable in line with the most recent Joint Bank-Fund Debt Sustainability Analysis (DSA, December 2021), which finds that the risk of debt distress is low for both external and public debt.

**Risks to the outlook are balanced.** Higher than expected inflation would reduce household purchasing power and drag growth, as would an extension of import restrictions. Welfare recovery remains uncertain due to rising inflation and risks to agricultural production. While a steeper drop in commodity prices would reduce the import bill and ease external pressures, a strong correction in oil prices could lower the demand for migrants in Gulf countries and weigh on remittance inflows.

**Table 3.** Macroeconomic projections of selected key indicators

	FY19	FY20	FY21	FY22e	FY23f	FY24f
<b>Real GDP growth, at constant market prices</b>	6.7	-2.4	4.2	5.8	5.1	4.9
Private Consumption	8.1	3.6	4.3	5.4	2.9	2.1
Government Consumption	9.8	3.8	-1.7	5.5	3.0	-5.3
Gross Fixed Capital Investment	11.3	-8.9	9.8	4.6	5.8	9.0
Exports, Goods and Services	5.5	-15.9	-21.1	35.0	20.3	18.4
Imports, Goods and Services	5.8	-20.8	16.3	15.0	3.9	4.1
<b>Real GDP growth, at constant factor prices</b>	6.4	-2.4	3.8	5.5	5.1	4.9
Agriculture	5.2	2.4	2.8	2.3	2.0	2.1
Industry	7.4	-4.0	4.5	10.2	8.9	9.2
Services	6.8	-4.5	4.2	5.9	5.6	5.1
<b>Inflation (Consumer Price Index)</b>	4.6	6.1	3.6	6.3	5.5	5.3
<b>Current Account Balance (% of GDP)</b>	-6.9	-0.9	-7.8	-12.8	-8.8	-5.7
<b>Net Foreign Direct Investment (% of GDP)</b>	0.3	0.5	0.5	0.4	0.4	0.4
<b>Fiscal Balance (% of GDP)</b>	-5.0	-5.4	-4.1	-3.5	-3.4	-2.4
<b>Debt (% of GDP)</b>	27.2	36.9	40.6	41.5	41.6	40.9
<b>Primary Balance (% of GDP)</b>	-4.5	-4.7	-3.3	-2.6	-2.3	-1.2

Source: Ministry of Finance, Nepal Rastra Bank, and Central Bureau of Statistics for history. World Bank staff for estimates and forecasts. Notes: e = estimate; f = forecast.





C

# SPECIAL FOCUS: THE MACROECONOMIC IMPACTS OF CLIMATE CHANGE IN NEPAL



# C

# SPECIAL FOCUS: THE MACROECONOMIC IMPACTS OF CLIMATE CHANGE IN NEPAL

Climate change is visibly impacting Nepal. Nepal ranks as the 10th most affected country in the world according to the Climate Risk Index.<sup>16</sup> The number of flood events has doubled in recent years; storms, erosion, and landslides are also on the rise, resulting in loss of life and livelihoods.<sup>17</sup> Heavy monsoon floods and landslides in 2020 caused hundreds of deaths, displaced thousands of people, and damaged many roads. Mountains are warming faster than the plains, triggering melting of ice and permafrost and an increase in the risk of landslides. Incidences of dry spells, droughts, forest fires, heatwaves, flash floods, and disease outbreaks are increasing along with slow-onset risk. Past growth in the country has come at a high cost to the environment and health,<sup>18</sup> and the current economic model needs to change to achieve green, resilient, and inclusive development (GRID).



<sup>16</sup> Eckstein, David, Vera Künzel, and Laura Schäfer. 2021. Global Climate Risk Index 2021: Who Suffers Most From Extreme Weather Events? Weather-Related Loss Events in 2019 and 2000–2019. Berlin: Germanwatch.

<sup>17</sup> World Bank Group and Asian Development Bank. 2021. Climate Risk Country Profile: Nepal. Washington, D.C.: World Bank and Manila: Asian Development Bank (ADB).

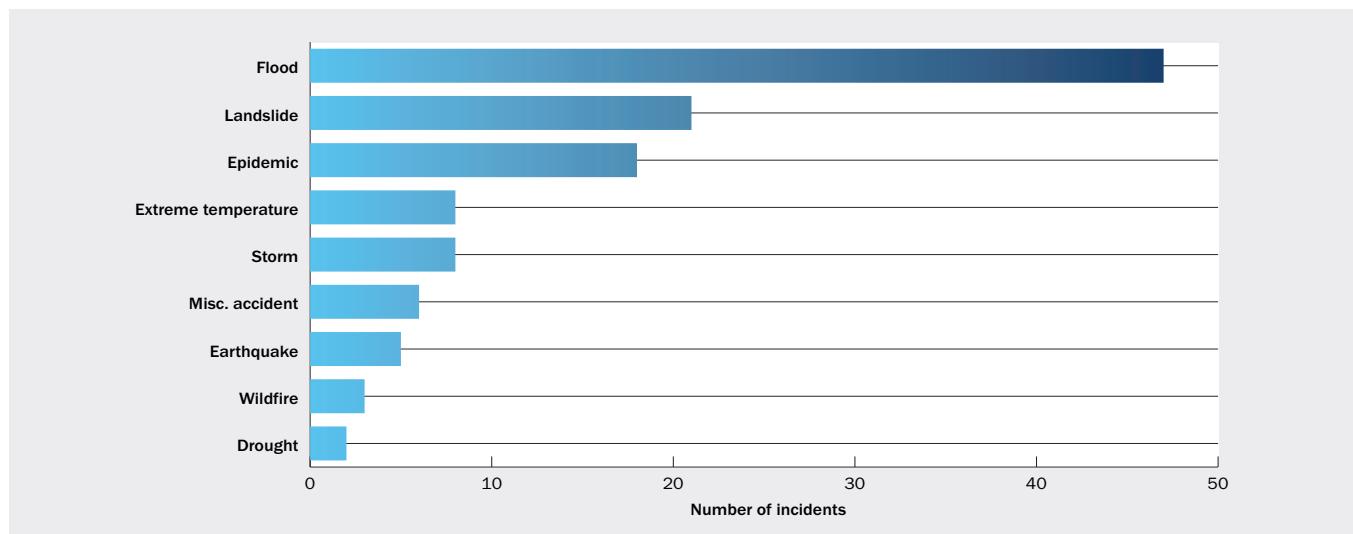
<sup>18</sup> In 2013, air pollution-induced loss of welfare was recorded at US\$2.8 billion, equivalent to nearly 5 percent of Nepal's GDP. Source: Clean Energy Nepal. 2013. Air Quality Status and Management in Kathmandu Valley: Make the City Air Breathable (MaYA Factsheet 5).

## C.1 CLIMATE CONTEXT

**Nepal is highly vulnerable to climate change and the underlying risks are expected to increase over time.** The Nepal government expects temperatures to increase by 0.9–1.1 degrees Celsius in the medium-term (2016–45) and 1.3–1.8 degrees Celsius in the long-term (2036–65) relative to the reference period 1981–2010.<sup>19</sup> The majority of the population is exposed to the risks of natural disasters and climate-induced hazards, exacerbating poverty and insecurity (Figure 31).

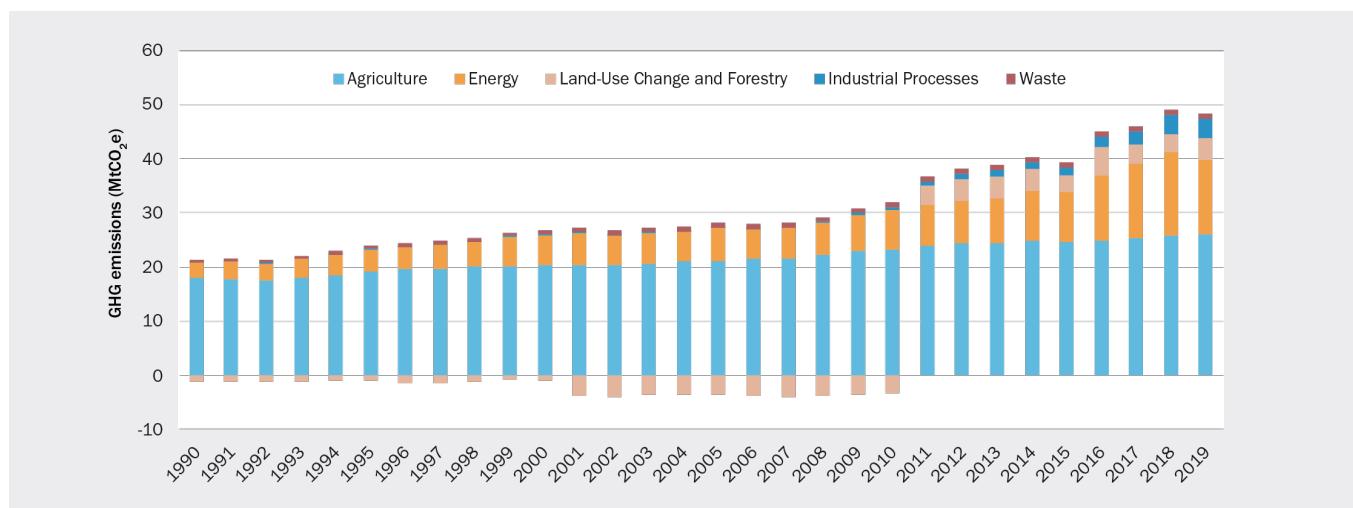
**Nepal does not emit a significant amount of greenhouse gas emissions but must adapt to global warming.** Nepal is a negligible contributor to global greenhouse gas (GHG) emissions, contributing around 0.1 percent of total global GHG emissions, primarily from agriculture (47 percent) and energy (43 percent). However, due to the rising energy consumption and carbon intensity, GHG emissions in Nepal increased by 16.4 percent between 2012 and 2017 (Figure 32).

**Figure 31.** Average annual national hazards occurrence in Nepal for 1980–2020



Sources: World Bank Climate Change Knowledge Portal: Nepal, Vulnerability (World Bank Group), <https://climateknowledgeportal.worldbank.org/country/nepal/vulnerability>

**Figure 32.** Nepal historical GHG emissions (MtCO<sub>2</sub>e)



Sources: Climate Watch Historical Country Greenhouse Gas Emissions Data (1990–2019)

<sup>19</sup> MoFE, 2019. Climate change scenarios for Nepal for National Adaptation Plan (NAP). Ministry of Forests and Environment, Kathmandu. Available from: [http://mofe.gov.np/downloadfile/MOFE\\_2019\\_Climate percent20change percent20scenarios percent20for percent20Nepal\\_NAP\\_1562647620.pdf](http://mofe.gov.np/downloadfile/MOFE_2019_Climate percent20change percent20scenarios percent20for percent20Nepal_NAP_1562647620.pdf)

## C.2 DEVELOPMENT CONTEXT

**Over the past decade, Nepal achieved gross domestic product (GDP) growth averaging 4.9 percent from FY09–FY19, enabling the country to attain lower-middle-income status in 2020.** Growth was broad-based, with multidimensional poverty estimated to have declined from 30.1 percent in 2014 to 17.4 percent in 2019. However, the country faces significant vulnerabilities to continue a path of inclusive and sustainable growth. A series of economic shocks starting with the 2015 earthquake have led to a surge in debt levels that need to be addressed, although the risk of debt distress remains low.

**Nepal's economic growth trajectory was challenging before climate change became a growing limitation.** Like many other landlocked countries, Nepal has struggled to

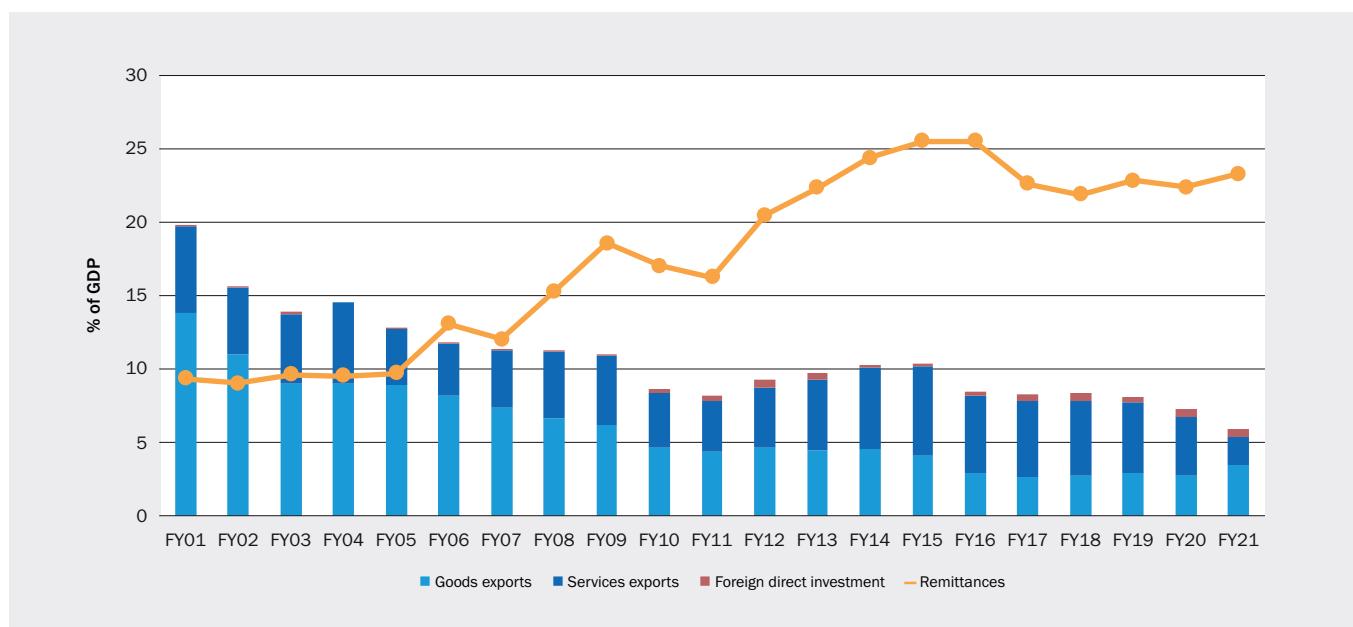
gain a foothold in merchandise export markets. On the services side, while tourism generates jobs domestically, it earns only 10 percent of total foreign exchange revenues. Migrant work and remittance inflows are likely to remain the key driver of growth in the future. However, it has been seven years since remittances peaked as a percentage of GDP (25 percent in 2016), and they may not return to this level. Nepal has enormous hydropower potential but must balance development of the sector with existing fiscal space and securing export markets. Ensuring macroeconomic stability and a sustainable debt burden is critical when planning multiple and larger-scale infrastructure investments. Export of electricity to India and Bangladesh may also generate a new stream of income.

### C.2.1 INTERNATIONAL MIGRATION AND REMITTANCES

**Remittances are the backbone of Nepal's economy and have been a key driver of poverty reduction in Nepal.** Since 2005, Nepal has earned more foreign exchange from remittances inflows than exports and foreign direct investment combined

(Figure 33). Between 1996 and 2011, remittances accounted for 27 percent of the poverty reduction in Nepal and were the main driver of equitable improvements in welfare.<sup>20</sup>

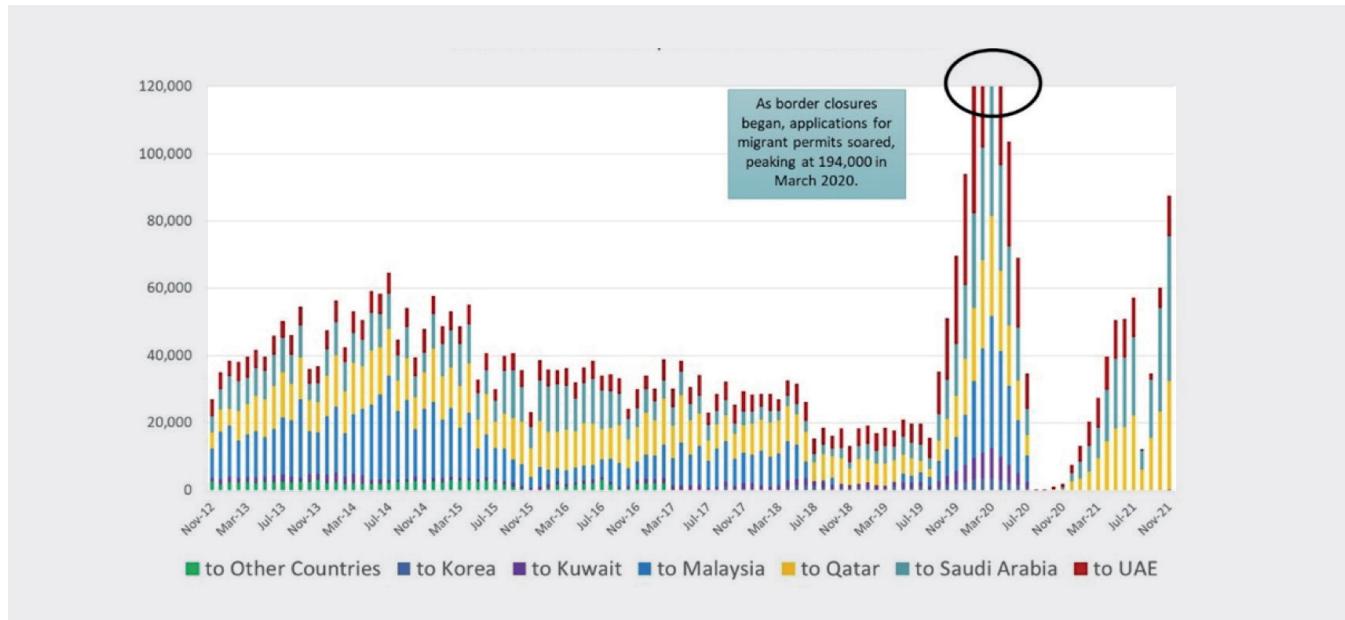
**Figure 33.** Nepal's sources of foreign exchange as percent of GDP (excluding debt flows)



Sources: Nepal Rastra Bank and World Bank staff calculations.

<sup>19</sup> MoFE, 2019. Climate change scenarios for Nepal for National Adaptation Plan (NAP). Ministry of Forests and Environment, Kathmandu. Available from: [http://mofe.gov.np/downloadfile/MOFE\\_2019\\_Climate percent20change percent20scenarios percent20for percent20Nepal\\_NAP\\_1562647620.pdf](http://mofe.gov.np/downloadfile/MOFE_2019_Climate percent20change percent20scenarios percent20for percent20Nepal_NAP_1562647620.pdf)

**Figure 34.** Nepali Migration to Host Countries, Excluding India due to the Open Border



Sources: Government of Nepal, Department of Foreign Employment.

**In Nepal, as in other developing countries, migration can support household resilience to shocks, including climate shocks, by scaling up remittances in response to a shock to the migrant household.** Using panel data from the Nepal Household Risk and Vulnerability Survey (HRVS) 2016-18, analysis finds a positive relationship between remittances and household spending on non-food items and health in 2017 and 2018, in the aftermath of the 2015 earthquakes. More recently, there is suggestive evidence that households with a migrant member and with a larger number of income sources were less likely to report economic distress when faced with a labor market shock due to COVID-19.

**A discussion of climate-resilient development in Nepal would not be complete without considering how climate change will impact economic conditions in the communities where migrants originate, and in the host countries where they are working.** Climate change is expected to have profound impact on remittances by changing the migration patterns. Internally, workers and their families who live in climate-impacted regions may seek more hospitable areas within Nepal or in another country in search of higher earning opportunities. Internationally, many host countries also face extreme heat and weather condition, which reduce outdoor job opportunities for Nepali migrants (Figure 34).

**The rising temperature in host countries due to climate change will further increase health risks for Nepali migrant workers working in outdoor occupations.** The top four destinations for Nepali workers are India, Saudi Arabia, Qatar, and the United Arab Emirates. A recent study has shown that during 2009-2017, about 3 to 4 male Nepali workers in Qatar died each week, and the primary cause of death was recorded as ‘cardiac arrest’.<sup>21</sup> The study finds that the increased cardiovascular death during hot weathers is most likely caused by severe heat stress. Over 1300 Nepali immigrants in Qatar have died during 2009-2017, equivalent to one death every day. In addition, India is also expected to experience higher temperatures, with over 12 days of temperatures above 35 °C each year by 2039. In the south region of Puducherry, over 81 days will be above 35°C each year.

**Climate-related heat and extreme weathers change working opportunities and may result in a shift towards more migrant work in other sectors including care services, which can impact the gender composition of Nepali overseas workers.** According to preliminary census data, Nepal's population is 29.2 million, with an estimated 2.2 million working overseas. Over 81 percent of registered migrants are male. However, between 2011 and 2021 there has been a 71 percent increase in registered female workers.<sup>22</sup> Since 2000, increasing numbers of Nepali nurses have entered the global healthcare market. The top destinations are the U.K., U.S., Australia, and New Zealand.<sup>23</sup>

<sup>21</sup> Pradhan, Bandara et al, July 2019 “Heat Stress Impacts on Cardiac Mortality in Nepali Migrant Workers in Qatar”, *Cardiology* 2019; 143:37-48, *Cardiovascular Prevention: Research Article*

<sup>22</sup> Kathmandu Post, January 27, 2022 “Nepal’s Population is 29,192,480” <https://kathmandupost.com/national/2022/01/27/nepal-s-population-is-29-192-480>

<sup>23</sup> Adhikari, Radha, June 2013 “Empowered Wives and Frustrated Husbands: Nursing, Gender and Migrant Nepali in the UK”, *International Migration* Vol 51, Issue 6, p. 168-179

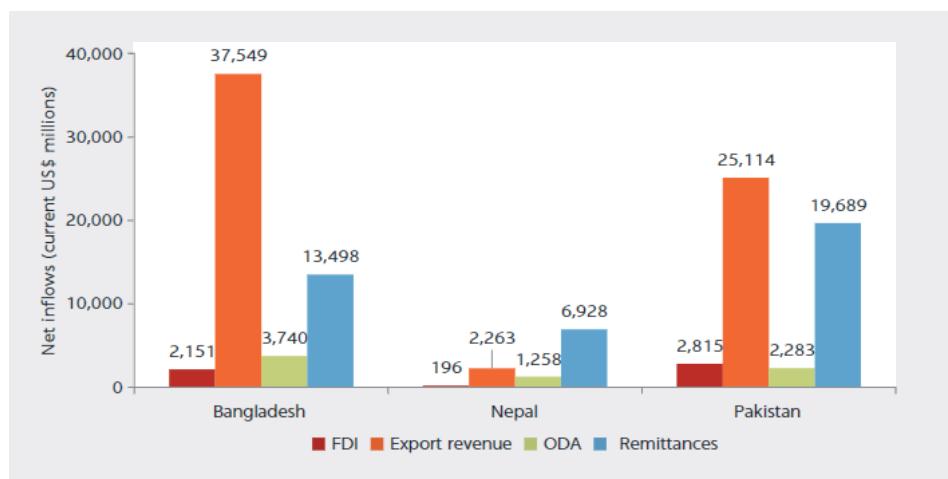
### Climate change impacts remittances by changing working opportunities in both Nepal and host countries.

Rising temperatures and increasing natural hazards reduce outdoor occupations and generate negative health impacts on workers, hence reducing remittance inflows. To compensate for the potential remittances loss, the authorities can establish policies that provide incentives to diversify and increase foreign exchange inflows.

### Investing in key skills and work profiles for a green transition will need to be key elements of the long-term agenda for creating better and more inclusive jobs within the country.

Nepal's current occupational profile does not lend itself readily to access new jobs from an emerging global green economy. There are potential gains to economic returns by improving both the migration and reassimilation process, particularly with a view of promoting investment in skills and expanding access to work experience for a green transition. Improving the efficiency of the migration process and investing in a higher skill profile for new cohorts of migrants can support domestic economic growth,<sup>24</sup> as can matching returning migrants with capital and other reassimilation resources.

**Figure 35.** Remittances Inflows to Major Migrant-Sending South Asian Countries Relative to FDI and ODA, 2019<sup>25</sup>



Sources: FDI, ODA, and export revenue data from World Development Indicators 2019; remittance inflow data from KNOMAD Remittances Database

Note: FDI = foreign direct investment, net inflows (balance of payments, current US\$); export revenue = exports of goods and services (current US\$); ODA = net official development assistance (current US\$); remittances = migrant remittance inflows (current US\$)

**Increasing the volume and value of exports is another avenue to compensating for a potential loss in remittances, as is raising foreign direct investment (FDI) inflows.** In neighboring countries, the source of foreign exchange earnings is much more balanced (Figure 35). For Nepal to plan for a gradual decline in remittance inflows over the coming century, incentives to increase FDI and export production could offset the loss in remittance earnings. An additional benefit would be the creation of productive jobs domestically to employ the labor that otherwise would leave the country. A more dynamic domestic economy would both benefit the workers who can stay with their families and communities, and support Nepal's longer term development ambitions.

## C.2.2 THE MACROECONOMIC IMPACT OF AIR POLLUTION

**Reducing GHG emissions and improving air quality and environmental health go hand in hand, and air pollution has been a concern in many low- and middle-income countries.** In 2016, the Environmental Performance Index (EPI) ranked Nepal as 177th out of 180 on air quality issues, just above India, China and Bangladesh. Air pollution is the largest component of the overall pollution burden, mainly due to welfare loss.

In a separate study undertaken the World Bank,<sup>26</sup> in 2015 total forgone output was USD 130 million, and the total welfare loss was USD 1362 million, representing around 0.6 and 6.4 percent of economic activity respectively. The economic cost of air pollution is calculated in terms of forgone labor output and lost welfare. PM2.5 contributed around 50 percent of forgone outcome losses, and 83 percent of welfare losses. In 2019, the annual welfare cost of household (indoor) air pollution was estimated

<sup>24</sup> McKenzie, David and Dean Yang, July 2015 "Evidence on Policies to Increase the Development Impacts of International Migration", The World Bank Research Observer, Oxford University Press

<sup>25</sup> Source: Ahmed, S. Amer, and Laurent Bossavie, eds. Toward safer and More Productive Migration for South Asia. International Development in Focus. Washington, D.C.: World Bank.

<sup>26</sup> World Bank Group, June 2019 "The Nepal Environmental Sector Diagnostic: Path to Sustainable Growth under Federalism"

to be about 3.5 percent of GDP; the welfare cost of ambient air pollution was about 3 percent of GDP.<sup>27</sup> The study also estimated the cost of air pollution under Sustainable Development Goals (SDG) conditions. SDG conditions assume that key environmental pollution-related SDG goals are achieved with strong policy action and air pollution has been reduced by 2030. Under a business-as-usual (BAU) scenario, the costs of forgone output grow from USD 130 million in 2015 to USD 136-256 million in 2030, and welfare loss grow from USD 1362 million to USD 1655-3885 million. The cost increase is mostly driven by the rising ambient PM2.5 in urban areas. However, under SDG conditions, total PM2.5 costs from forgone output decrease to USD 48-91 million in 2030 and to USD 591-1386 million in terms of welfare loss.

**The forgone output is calculated as the present value (PV) of forgone lifetime earnings, which is an estimate of the cost of premature mortality of workers.** To approximate the PV of lost income, a function of per capita consumption expenditure over the period of lost years is used, along with other indicators including life expectancy minus average age of death, the discount rate, and the expected future per capita income growth rate. Forgone lifetime earnings were estimated using PV of earnings multiplied by labor force participation rate

and survival rate during the period of life lost. An alternative approach is to estimate the welfare loss, which is calculated by multiplying the estimated number of premature deaths with the value of statistical life (VSL). For the projection through 2030, Nepal's mortality rates were predicted based on data from other countries at similar stages of development. To convert the predicted mortality into the cost of environmental degradation estimations, the study used 2030 population structure data projected by the Nepal Central Bureau of Statistics. Additionally, the study predicted both the labor force participation rate and consumption expenditure per capita, allowing the estimate of cost of environmental degradation in 2030.

**The primary source of airborne pollutants in Nepal is the burning of fossil fuels during heating, power generation, and other combustion processes.** Data has shown that the concentration of air pollution in Kathmandu at main roads and house veranda was 13 and 4 folds higher than WHO air quality guidelines in 2007. With the rapid urbanization and development of infrastructure, air pollution is expected to become more concentrated and spread to other parts in Nepal. Although the authorities launched emission control policies, their implementation has not yet become effective.<sup>28</sup>

## C.2.3 THE MACROECONOMIC IMPACT OF HARDENING BUILT INFRASTRUCTURE

**Flooding damages to infrastructure are severe in Nepal.** The probability of damages and associated costs of flooding for Nepal are shown in Table 4. The column 'no additional warming' shows the probability of a flood destroying 2.55 percent of built

infrastructure and capital stock (return period of 50 years) at 2.0 percent today. As temperatures rise, that probability triples to 5.7 percent with 1.5°C of additional warming and more than triples again to 18.4 percent under 3.2°C of additional warming.

**Table 4.** Current and Estimated Probabilities for Flood Damages of a Given Size

Probability under additional warming scenarios from 2020 through 2100 (%)					
Return period (years)	Damage (% of capital stock)	No additional warming (*)	0.5°C of additional warming (RCP 2.6)	1.5°C of additional warming (RCP 4.5)	3.2°C of additional warming (RCP 8.5)
20	1.66	5.00	7.07	14.14	45.95
50	2.55	2.00	2.83	5.66	18.38
100	2.96	1.00	1.41	2.83	9.19
250	3.67	0.40	0.57	1.13	3.68
500	4.33	0.20	0.28	0.57	1.84
1,000	4.62	0.10	0.14	0.28	0.92
1,500	4.70	<0.10	0.09	0.19	0.61

**Source:** Background data for UNISDR (United Nations Office for Disaster Risk Reduction). 2015. Making Development Sustainable: The Future of Disaster Risk Management. Global Assessment Report on Disaster Risk Reduction. Geneva. <https://www.preventionweb.net/english/hyogo/gar/2015/en/home>.

**Note:** RCP 2.6, RCP 4.5, and RCP 8.5 represent climate trajectories envisioned by the IPCC, based on projected GHG emission. Data on estimated flooding damages for Nepal come from UNISDR (2015).

<sup>27</sup> World Bank Group "Nepal Environment Sector Diagnostic: Path to Sustainable Growth Under Federalism", 2019.

<sup>28</sup> Kurmi OP, Semple S, Devereux GS, Gaihre S, Lam KB, Sadhra S, Steiner MF, et al.. The effect of exposure to biomass smoke on respiratory symptoms in adult rural and urban Nepalese populations. Environmental Health; 2014. 13(1): p. 92. <http://dx.doi.org/10.1186/1476-069X-13-92>

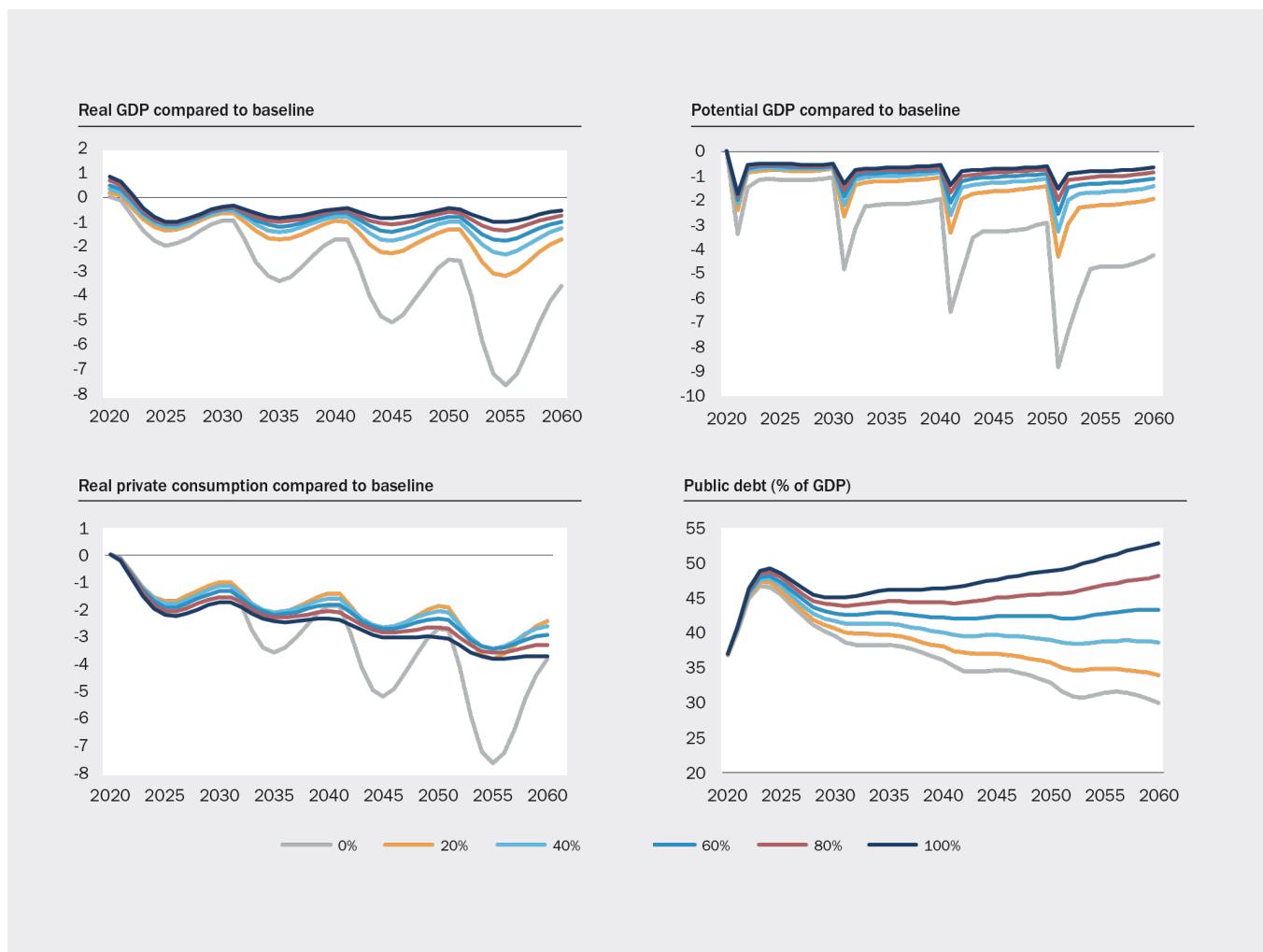
The anticipated damages from flooding in any given year also multiply at these rates.<sup>29</sup>

**Public budget envelopes are tight and there are trade-offs between investing in infrastructure versus any other public good or service.** In the simulation, under the most severe warming scenario periodic 10-year recurring damage events are imposed (the downward spikes in (Figure 36). The severity and frequency of the damage events are likely to increase over time as the climate warms. Two separate investments are embedded in the model—the ex-ante hardening of existing infrastructure and the ex-post reconstruction of damaged infrastructure. Following a damage event, reconstruction occurs to replace damaged infrastructure. This is shown as the upward slope of the projections following each damage event

and occurs in all hardening estimations. The multiple lines in each graph depict how much infrastructure is hardened before the event occurs, ranging from 0 percent (no preemptive hardening) to 100 percent (all infrastructure is hardened before a damage event).

Under this model construction, preemptively hardening key—and not all—infrastructure provides the strongest economic support to recovery at the lowest total cost to the economy. While hardening all infrastructure (100 percent) results in the smallest erosion of potential GDP by 2050, the costs of such a large investment weigh heavily on public debt. Depending on the nature of built infrastructure in Nepal, the percentage of infrastructure to harden before a damage event occurs may optimally be 10 percent, 20 percent, or even 30 percent.

**Figure 36. Flood Protection: Comparison Across Varying Degrees of Disaster Management Investment (RCP8.5 scenario)<sup>30</sup>**



Sources: World Bank projections based on the MFMod-CC model.

<sup>29</sup> These estimations are based on Nepali data on damages and frequency and the assumption that the frequency of floods of any given size doubles with every degree increase in temperature. Myhre, G., K. Alterskjær, C. W. Stjern, Ø. Hodnebrog, L. Marelle, B. H. Samset, J. Sillmann, N. Schaller, E. Fischer, M. Schulz, and A. Stohl. 2019. “Frequency of Extreme Precipitation Increases Extensively with Event Rareness under Global Warming.” *Scientific Reports* 9 (1).

<sup>30</sup> World Bank Group, September 2022 “Nepal Country Climate and Development Report” <https://openknowledge.worldbank.org/bitstream/handle/10986/38012/FullReport.pdf>

## C.2.4 HYDROPOWER EXPANSION AND THE IMPACT ON MACROECONOMIC STABILITY

**Nepal has among the world's largest hydroelectric power resources, with over 42 GW of economically feasible potential.<sup>31</sup>** Around 90 percent of Nepal's electricity generation is sourced from hydropower. While the role of the private sector in investments in hydropower has steadily grown, financial and climate-related risks to the hydropower sector have the potential to transmit material contingent liabilities to the sovereign, due to the state-owned Nepal Electricity Authority's (NEA's) ownership of a significant share of the country's hydropower assets. The challenge is not only to assess average water availability in the future but also how the growing threat of natural hazards may potentially impact hydropower and dams.

**The investment need is substantial.** The total hydropower generation investment required by NEA and the private sector in line with the business-as-usual (BAU) scenario is about US\$9.1 billion from 2022 through 2040. From 2012 to 2021, the average annual investment (public and private) made in hydropower generation was US\$424 million. From 2022 to 2040, the average annual investment of the BAU forecast rises slightly to US\$482 million. A careful balance of public and private sector investments—combined with guarantee and insurance financial products to bring financing costs down—is required to ensure that the power generated from investments retains the affordability that economic assessments predict.

**The expansion of hydropower generation capacity through 2033 is projected to boost growth and investment while incurring a relatively modest additional public debt (Table 5).** The new investment required for this expansion is estimated at US\$6.4 billion from 2022 to 2033 (an annual average investment of US\$ 535 million). As a result, annual GDP is projected to expand by 0.47 percent by 2033, relative

to the baseline projection (see Table 5). The composition of GDP is also projected to shift, pivoting slightly away from the services sector (shrinking from 64 percent to 61.3 percent of GDP) while the industrial sector expands (from 14.7 percent to 17.5 percent of GDP) by 2033.

**Export earnings are projected to improve slightly with the new electricity export stream, rising 0.5 percentage points of GDP per year by 2030 relative to the baseline projection.**

The current account balance would improve as well, as by 2033, net exports are expected to remain 0.1 percentage points of GDP higher than in the baseline projection.

**The fiscal impact of the investments is projected to be moderately low.** Public debt would rise only 2 percentage points of GDP higher than in the baseline projection by 2033, of which 1.6 percentage points of GDP would come from external borrowing.

**The modeling does not capture the important contribution that fulfillment of domestic electricity demand will have on domestic production.** Unreliable access to power is consistently identified by firms as the greatest obstacle to their operations. In the absence of load-shedding, households and businesses will experience productivity and competition gains. Investment associated with the development of new hydropower plants, transmission lines, and distribution networks has the potential to boost economic growth during the construction phase, improve economywide productivity through the continuous availability of electricity, and generate new fiscal revenues.<sup>32</sup> Implementing this hydropower investment plan would remove one of the principal constraints to economic growth in Nepal and unleash higher private sector productivity and growth.



<sup>31</sup> Upadhyay, S. N., and P. Gaudel. 2018. "Water Resources Development in Nepal: Myths and Realities." Hydro Nepal 23.

<sup>32</sup> Cosic, Dahal, and Kitzmuller 2017.

**Table 5.** Macroeconomic Impact of the Hydropower Investment Plan through 2033

	Baseline				Hydropower investment (to 2033) Deviation from baseline (percent or percentage points*)			
	2020	2025	2030	2033	2020	2025	2030	2033
<b>Average growth (%)</b>								
Real GDP	4.20	6.30	5.60	4.70	0.00	0.36	0.47	0.47
Real GDP per capita	2.70	4.50	4.50	4.00	0.00	0.36	0.47	0.47
<b>Per Capita Income and Consumption (constant 2020 US\$)</b>								
Real GDP Per Capita	1,113	1,388	1,729	1,955	0.00	0.36	0.47	0.47
Real Household Consumption Per Capita	948	1,115	1,435	1,654	0.00	-0.79	-0.88	-0.13
<b>Shares in GDP (% of GDP)</b>								
Private Consumption	80.70	76.10	78.60	80.10	0.00	-0.87	-1.06	-0.48
Government Consumption	8.40	11.30	11.50	11.60	0.00	-0.01	-0.02	-0.04
Private Investment	26.00	29.10	30.40	30.80	0.00	0.55	0.28	-0.14
Government Investment	8.80	9.10	9.30	9.50	0.00	0.07	0.28	0.41
Net Exports	-32.50	-37.10	-38.50	-39.60	0.00	0.17	0.38	0.10
<b>Sectoral shares in GDP (% of GDP)</b>								
Agriculture	30.60	26.30	22.90	21.30	0.00	-0.05	-0.05	-0.05
Industry	15.50	15.10	14.90	14.70	0.00	2.42	2.64	2.79
Services	54.00	58.60	62.20	64.00	0.00	-2.38	-2.59	-2.74
<b>External balance (% of GDP)</b>								
Exports, Goods and Services	6.80	6.20	5.30	4.80	0.00	0.35	0.55	0.24
Imports, Goods and Services	34.10	42.20	38.50	36.90	0.00	-0.11	-0.05	0.15
Current Account Balance	-0.90	-6.30	-6.20	-5.40	0.00	0.08	0.34	0.18
<b>Fiscal Aggregates (% of GDP)</b>								
Fiscal revenue (inlcld. Grants)	22.20	25.80	25.40	25.30	0.00	0.26	0.37	0.46
Fiscal expenditure (inlcld. Transfers to SNGs)	27.60	31.90	31.30	31.20	0.00	0.06	0.35	0.59
- o/w Interest payments	0.70	0.90	0.80	0.70	0.00	0.00	0.00	0.01
Budget deficit	-5.40	-6.10	-5.90	-5.80	0.00	0.17	-0.02	-0.14
Public debt	36.90	45.40	39.20	38.40	0.00	-0.41	0.70	2.07
- o/w External Public Debt	21.10	22.10	17.40	16.30	0.00	-0.07	0.79	1.61
<b>Emissions</b>								
Emissions (Mtons CO2)	0.10	0.10	0.10	0.10	0.00	0.05	0.06	0.05
Emissions per unit of output (tons CO <sub>2</sub> )	0.00	0.00	0.00	0.00	0.00	-0.32	-0.41	-0.41
<b>Impact (% of GDP)</b>								
Total*					0.00	0.36	0.47	0.47
<b>Memorandum items</b>								
Population (Millions)	30.0	32.7	34.4	35.0				

Source: World Bank projections based on the MFMod-CC model.

Note: \* Deviations from baseline are expressed as percent of baseline level for real GDP per capita, emissions, and carbon price. For all other variables deviations from baseline are expressed as percentage points of GDP in the corresponding scenario less the % of GDP in the baseline scenario.

The following sections discuss the channels and projected costs of climate impact under various scenarios.

## C.3 MODELING THE IMPACT OF CLIMATE CHANGE ON THE NEPALI ECONOMY

**The World Bank periodically updates its analysis of macroeconomic developments through a macro-structural model (MFMod)** which incorporates global developments as well as Nepal-specific policy changes and developments. MFMod was used to create the forecasts presented in the first section of this development update, for example.

**Fully assessing the climate impacts on economy is not yet possible, due to the uncertainties of extreme weathers and capacities of models.** This section articulates three of the major transmission channels of the climate change impact. There are other important climate change impacts that are not modeled in this exercise including wildfires, droughts, and many others, and therefore the estimations presented below should be considered a lower bound of expected impact on the Nepali economy.

**An expanded version of this model, a Climate Change Macro-Fiscal Model (MFMod-CC), has been used to model the links between damages caused by climate change and macroeconomic aggregates.** A description of the MFMod-CC is provided in Annex 2. The MFMod-CC for Nepal has been used to estimate:

- (a) a baseline growth scenario which assumes no additional climate change impacts beyond what has already been experienced up to 2021;
- (b) three separate growth scenarios under increasingly severe climate change outcomes: Representative Concentration Pathway (RCP) 2.6, RCP 4.5, and RCP 8.5;<sup>33</sup> modeled through three channels of transmission: the impact of higher temperatures on agricultural output, heat impacts on labor productivity, and flooding impacts on built infrastructure;
- (d) the impact of the hydropower investment plan on macroeconomic aggregates, including the fiscal deficit and public debt stock (described above); and
- (e) the macroeconomic impact of various degrees of ex ante hardening and ex post reconstruction of built infrastructure following recurring shocks to built infrastructure (also described above).

**The negative macroeconomic impacts projected by 2100 are a strong signal that the government needs to act now to adapt to climate change, so that Nepal can reduce the potential climate damage escalation in the latter half of 21<sup>st</sup> century.**

### C.3.1 BASELINE MFMOD-CC MACROECONOMIC AND GROWTH SCENARIO

**The baseline scenario assumes there's no additional warming and climate impact beyond what the country has already experienced up to 2021.** No policy change is imposed from 2020 to 2100 under the baseline, including those to promote an export-oriented economy. Emissions are projected to remain 0.1 mtons CO<sub>2</sub> from 2020 to 2050, and gradually increase to 0.4 mtons CO<sub>2</sub> by 2100. Emission per unit of output remains 0. GDP growth is expected to continue recovering from the COVID-19 pandemic and gain momentum through the decade of 2030 before experiencing a gradual decline through 2100 as population growth slows.

- Real annual GDP growth is projected to reach 5.9 percent in 2030 and slowly decline to 2.2 percent average annual growth in 2100. The service sector is expected to be a significantly driver of real GDP growth in the future, with a share of 62.2 percent in GDP by 2030 and 78 percent by 2100. The share of agriculture is projected to decline to 7.9 percent by 2100, around a quarter of its share in 2020.
- Although the growth rate is projected to decline, each decade begins with a higher GDP level resulting in a projected continuous improvement in GDP per capita.

<sup>33</sup> RCP = Representative Concentration Pathway, which is a greenhouse gas concentration trajectory adopted by the Intergovernmental Panel on Climate Change). RCP 2.6 is a scenario where global carbon dioxide emissions begin declining in 2020 and are reduced to zero by 2100, and average global temperatures rise 1.5oC. The RCP 4.5 scenario is an intermediate scenario, where emissions peak around 2040 and then decline with average global temperatures rising by 2.5oC. RCP 8.5 is the most pessimistic scenario used in this analysis, as global emissions continue to rise through the end of the century and average global temperatures rise 4oC.

Real GDP per capita is projected to be more than triple in real terms from US\$1,113 in 2020 to US\$3,841 by 2050. By the end of the century, the baseline scenario projects per capita income reaching US\$ 13,655 in constant 2020 US dollar terms.

- The trade deficit is projected to continue widening through 2100, leading to ever-larger current account deficits reaching -11.6 percent of GDP in 2100 under these business-as-usual (BAU) assumptions.

- Private investment represented 26 percent of real GDP in 2020 and is projected to increase to 31 percent in 2100. In a developing country context, private investment accounts for a significant share of the Nepal economy. Public investment is projected to rise at a much slower pace through the end of the century, from 8.8 to 9.7 percent of GDP from 2020 to 2100.
- Government consumption was 8.4 percent of GDP in 2020 and is projected to rise to 12 percent of GDP by 2100 in the baseline scenario.

### C.3.2 MODELING THE MACROECONOMIC IMPACT OF WARMING SCENARIOS – RCP 2.6, 4.5, AND 8.5

GDP and other macroeconomic losses in the first three decades of the 21st century are small to begin with, but accelerate quickly in the second half of the century as temperatures and climate events reach higher levels of intensity.

#### The RCP2.6 scenario

In the RCP 2.6 scenario, the most optimistic scenario, global carbon dioxide emissions begin declining in 2020 and are reduced to zero by 2100, and average global temperatures rise by 1.5oC. Model projection results for Nepal under this global warming scenario, relative to the baseline projection, include:

- Nepal's emissions are projected to fall by 0.72 percent from the baseline scenario by 2030, and by 5 percent by 2100 due to the country's smaller GDP (6 percent smaller) caused by climate change. Rising temperatures and greater climate-related shocks would slow economic activities across the board, resulting in a decline in total emissions relative to the baseline projection.
- Real GDP is projected to be 1.7 percent smaller by 2030, and 3.3 percent smaller by 2050 due to climate change. By 2100, the GDP reduction is projected to be 6.1 percent, almost double the contraction projected in 2050.
- The services sector is projected to contract by 0.28 percent of GDP in 2050, as the share of agriculture grows by 0.26 percent and industry sector grows by 0.01 percent of GDP relative to the baseline scenario. In 2100, the contraction of service sector remains around 0.26 percent.

#### The RCP4.5 scenario

The RCP 4.5 scenario is an intermediate scenario, where average global temperatures rise by 2.5oC. Under this modeling scenario:

- Real GDP is projected to shrink by 1.9 percent by 2030, by 4.5 percent by 2050, and 9.7 percent by 2100.
- Relative to the baseline, the share of the agriculture sector in GDP would expand by 0.4 percent of GDP, while service sector would decline by 0.4 percent of GDP in 2100.
- By 2100, net exports as a share of GDP would expand by 3.9 percent relative to the baseline as imports fall, reflecting lower consumption and investment.
- The government would face a loss of 0.3 percent of GDP in fiscal revenue by 2100, leading to public debt increasing by 2.3 percent of GDP relative to the baseline.
- The current account balance would improve by 1.1 percent of GDP by 2100 relative to the baseline projection, as imports contract.

#### The RCP 8.5 scenario

The RCP 8.5 is the most pessimistic scenario used in this analysis, as global emissions continue to rise through the end of the century and average global temperatures rise 4°C.

- By 2100, emissions are projected to shrink by 19.2 percent relative to the baseline.
- Real GDP is projected to shrink dramatically by 23.9 percent by 2100, increasing around tenfold the impact when compared to 2030.

- The shift in the sectoral composition of GDP is accelerated under this scenario, as the services sector contracts by 1.2 percent of GDP relative to the baseline and the agricultural sector expands by 1.2 percent.
- Fiscal revenue is projected to shrink by 0.2 percent of GDP relative to the baseline by 2050, and by 0.7 percent of GDP by 2100.

- Public debt is projected to increase by 5.4 percent of GDP relative to the baseline in 2100.
- The current account balance is projected to improve by 0.7 percent of GDP by 2050 and by 2.8 percent of GDP by 2100 as imports are muted.

### C.3.3 CHANNELS OF TRANSMISSION OF CLIMATE CHANGE IMPACTS

In this final section, we unpack the causal chain of transmission of each of the three damages that have been modeled in these estimations.

#### Channel #1: Heat Impacts on Agriculture: Rising Temperatures on Crop Yields

**Climate change reduces agriculture activity and can cause severely negative macroeconomic impacts.** Rising temperatures, evaporation, and erratic precipitation at critical cropping times significantly impact crop growth, as do the incidence of pests and diseases. Reductions in soil moisture can lead to prolonged droughts resulting in productivity losses and crop failures. Heavier precipitation contributes to erosion, landslides, and floods resulting in the loss of arable land, accelerated soil degradation, and reduction in fertility. These effects are sometimes compounded by droughts followed by excess precipitation.

By modeling the effect of rising temperatures on crop yields, GDP is projected to shrink by between 0.7 and 0.8 percent through 2030 across warming scenarios (the row “o/w Heat on Agriculture” in Annex 1). Larger differences are projected to emerge by 2100, with impacts projected to range between 1.1 and 8.3 percent of GDP.

#### Channel #2: Flooding and Flood-Related Damages on Infrastructure

**Infrastructure is severely damaged by floods in Nepal, and the frequency and severity of extreme events are expected to continue increasing.** Table 6 shows the probability of damages and associated costs of flooding in Nepal. With no additional warming, the probability of a flood destroying 2.6 percent of built infrastructure and capital stock (return period of 50 years) is 2.0 percent. As temperatures continue to rise, the probability grows to 5.7 percent with 1.5°C of additional warming and to 18.4 percent with 3.2°C of additional warming.

**Table 6.** Current and estimated probabilities for flood damages of a given size

		Probability under Additional Warming Scenarios Since 2020 through 2100			
Return period (years)	Damage (percent of capital stock)	No additional warming (*)	0.5°C of additional warming [RCP 2.6]	1.5°C of additional warming [RCP 4.5]	3.2°C of additional warming [RCP 8.5]
20	1.66%	5.00%	7.07%	14.14%	45.95%
50	2.55%	2.00%	2.83%	5.66%	18.38%
100	2.96%	1.00%	1.41%	2.83%	9.19%
250	3.67%	0.40%	0.57%	1.13%	3.68%
500	4.33%	0.20%	0.28%	0.57%	1.84%
1000	4.62%	0.10%	0.14%	0.28%	0.92%
1500	4.70%	<0.1%	0.09%	0.19%	0.61%

**Source:** Background data for UNISDR (United Nations Office for Disaster Risk Reduction). 2015. Making Development Sustainable: The Future of Disaster Risk Management. Global Assessment Report on Disaster Risk Reduction. Geneva. <https://www.preventionweb.net/english/hyogo/gar/2015/en/home>.

**Note:** RCP 2.6, RCP 4.5, and RCP 8.5 represent climate trajectories envisioned by the IPCC, based on projected GHG emission. Data on estimated flooding damages for Nepal come from UNISDR (2015).

**Of the three climate shocks projected in the model for Nepal, flood damage on infrastructure is projected to have the largest impact on the macroeconomy.** By damaging infrastructure such as roads and buildings, flooding is projected to reduce the capital stock, potential output and production. Relative to the baseline, GDP is projected to shrink by between 1 and 1.1 percent through 2030 across warming scenarios (the row “o/w Flooding on Infrastructure” in Annex C.1). Larger differences are projected to emerge by 2100, with impacts projected to range between 4.5 and 12.9 percent of GDP.

### Channel #3: Heat Impacts on Labor Productivity and Health

**Labor productivity is very sensitive to temperature changes.** Rising temperatures reduce productivity and are projected to cause a loss of 1.4 percent of GDP by 2050 under the RCP 8.5 scenario. Lower productivity also translates into lower household income, therefore reducing domestic demand and consumption.

**Despite the progress Nepal has made in key health indicators such as reduced child mortality and improved health coverage, climate change is one of the top threats to public health and livelihoods.** Direct risks include traumatic injury caused by extreme heat or flooding, worsened noncommunicable disease and mental health. In addition, climate change generates ecosystem-mediated risks including vector-borne diseases such as dengue and malaria, and indirect risks such as poverty, conflict, and migration.

**Although rising temperatures reducing labor productivity is projected to have the smallest impact on the macroeconomy, this is a partial estimation as the compound impacts of heat, disease, migration, and other related impacts on labor productivity are not modeled.** GDP is projected to shrink by between 0.03 and 0.5 percent through 2030 across warming scenarios (the row “o/w Heat on Labor Productivity” in Annex C.1). Larger differences are projected to emerge by 2100, with impacts projected to range between 0.6 and 4.9 percent of GDP.

# **ANNEX**

## ANNEX C.1: MACROECONOMIC FORECASTS UNDER CLIMATE SCENARIOS

	Baseline				RCP 2.6				RCP 4.5				RCP 8.5				
	2020	2030	2050	2100	2020	2030	2050	2100	2020	2030	2050	2100	2020	2030	2050	2100	
<b>Average growth (%)</b>																	
Real GDP	4.20	5.90	3.90	2.20	0.00	-1.65	-3.33	-6.11	0.00	-1.87	-4.46	-9.72	0.00	-2.36	-6.92	-23.88	
Real GDP per capita	4.20	5.90	3.90	2.20	0.00	-1.65	-3.33	-6.11	0.00	-1.87	-4.46	-9.72	0.00	-2.36	-6.92	-23.88	
<b>Per Capita Income and Consumption (constant 2020 US\$)</b>																	
Real GDP Per Capita	1,113	1,729	3,841	13,655	0.00	-1.65	-3.33	-6.11	0.00	-1.87	-4.46	-9.72	0.00	-2.36	-6.92	-23.88	
Real Household Consumption Per Capita	948	1,435	3,441	12,846	0.00	-1.77	-3.43	-6.13	0.00	-2.01	-4.59	-9.76	0.00	-2.54	-7.11	-23.92	
<b>Shares in GDP (% of GDP)</b>																	
Private Consumption	80.70	78.60	84.80	89.10	0.00	-0.10	-0.10	-0.01	0.00	-0.11	-0.12	-0.04	0.00	-0.14	-0.17	-0.04	
Government Consumption	8.40	11.50	11.70	12.00	0.00	0.01	0.04	0.08	0.00	0.01	0.05	0.13	0.00	0.02	0.08	0.36	
Private Investment	26.00	30.40	31.50	31.00	0.00	-0.05	-0.03	-0.01	0.00	-0.05	-0.05	-0.02	0.00	-0.07	-0.09	-0.12	
Government Investment	8.80	9.30	9.60	9.70	0.00	0.01	0.03	0.07	0.00	0.01	0.04	0.11	0.00	0.01	0.06	0.28	
Net Exports	-32.50	-38.50	-41.40	-42.80	0.00	0.61	1.31	2.44	0.00	0.69	1.75	3.89	0.00	0.88	2.71	9.61	
<b>Sectoral shares in GDP (% of GDP)</b>																	
Agriculture	30.60	22.90	14.80	7.90	0.00	0.21	0.26	0.26	0.00	0.24	0.36	0.42	0.00	0.30	0.57	1.18	
Industry	15.50	14.90	14.20	14.00	0.00	0.01	0.01	0.01	0.00	0.01	0.02	0.01	0.00	0.02	0.03	0.03	
Services	54.00	62.20	71.00	78.20	0.00	-0.22	-0.28	-0.26	0.00	-0.25	-0.38	-0.43	0.00	-0.32	-0.60	-1.21	
<b>External balance (% of GDP)</b>																	
Exports, Goods and Services	6.80	5.30	3.00	1.80	0.00	0.08	0.09	0.10	0.00	0.09	0.13	0.17	0.00	0.12	0.20	0.48	
Imports, Goods and Services	34.10	38.50	37.00	36.50	0.00	-0.21	-0.38	-0.72	0.00	-0.24	-0.52	-1.15	0.00	-0.31	-0.83	-3.01	
Current Account Balance	-0.90	-6.20	-8.90	-11.60	0.00	0.17	0.36	0.66	0.00	0.19	0.47	1.07	0.00	0.23	0.72	2.75	
<b>Fiscal Aggregates (% of GDP)</b>																	
Fiscal revenue (+ grants)	22.20	25.40	25.90	26.10	0.00	-0.06	-0.10	-0.18	0.00	-0.07	-0.14	-0.28	0.00	-0.09	-0.22	-0.74	
Fiscal expenditure (+ transfers to SNGs)	27.60	31.30	31.10	31.20	2.58	2.78	2.88	2.92	2.58	2.77	2.86	2.89	2.58	2.76	2.83	2.72	
- o/w Interest payments	0.70	0.80	0.60	0.50	0.00	0.01	0.01	0.03	0.00	0.01	0.02	0.05	0.00	0.01	0.03	0.14	
Budget deficit	-5.40	-5.90	-5.30	-5.10	0.00	-0.03	-0.07	-0.13	0.00	-0.04	-0.09	-0.21	0.00	-0.05	-0.15	-0.55	
Public debt	36.90	39.20	31.70	24.30	0.00	0.02	0.56	1.42	0.00	0.01	0.69	2.31	0.00	0.01	0.97	5.39	
- o/w External Public Debt	21.10	17.40	11.80	8.60	0.00	-0.01	0.19	0.50	0.00	-0.02	0.24	0.82	0.00	-0.03	0.34	1.91	
<b>Emissions</b>																	
Emissions (Mttons CO2)	0.10	0.10	0.10	0.40	0.00	-0.72	-2.24	-4.99	0.00	-0.82	-2.94	-7.98	0.00	-1.04	-4.47	-19.17	
Emissions per unit of output (tons CO2)	0.00	0.00	0.00	0.00	0.00	0.94	1.12	1.20	0.00	1.07	1.59	1.93	0.00	1.36	2.64	6.19	
<b>Impact (% of GDP)</b>																	
Total*						0.00	-1.65	-3.33	-6.11	0.00	-1.87	-4.46	-9.72	0.00	-2.36	-6.92	-23.88
-o/w Heat on Agriculture						-0.01	-0.68	-0.80	-1.09	-0.01	-0.72	-1.22	-3.25	-0.01	-0.83	-2.24	-8.28
-o/w Heat on Labor Productivity						0.00	-0.03	-0.34	-0.64	0.00	-0.16	-0.66	-1.92	0.00	-0.48	-1.43	-4.91
-o/w Flooding on Infrastructure						0.00	-0.95	-2.25	-4.48	0.00	-1.00	-2.66	-4.89	0.00	-1.07	-3.45	-12.86
<b>Memorandum items</b>																	
Population (Millions)	30.0	34.4	36.4	36.5													

\* Deviations from baseline are expressed as percent of baseline level for Real GDP Per Capita, Emissions, and Carbon Price. For all other variables deviations from baseline are expressed as percentage points of GDP in the corresponding scenario less the % of GDP in the baseline scenario. Damages are not additive. Source: World Bank projections using the MFMod-CC model

## ANNEX C.2: THE MACRO-CLIMATE MODEL MFMOD-CC

The World Bank MFMod-CC extends the core MFMod macrostructural model by including a standard set of variables and equations necessary for forecasting, economic policy, and budget planning analyses typically conducted by central ministries. A detailed technical description of MFMod is provided in Burns et al. (2019),<sup>34</sup> while Burns et al. (2021)<sup>35</sup> describe some of the climate change extensions included in the MFMod-CC.

The long-run behavior of the model is determined by a mixture of calibrated and estimated parameters following a neoclassical framework, while the short-run out-of-equilibrium behavior is primarily data driven. External and domestic shocks perturb the economy away from equilibrium based on the historical adjustments of the economy. The functional forms of the equations are derived from economic theory where household tends to optimize consumption decisions to maximize utility, and firms minimize costs by adjusting their use of factor inputs. Although not fully micro-consistent in the way that computable general equilibrium or dynamic stochastic general equilibrium models are, it is a general equilibrium model that covers the entire macroeconomy by linking various accounts through a set of identities and behavioral equations.

The model's climate extensions draw from the existing climate literature to introduce emission and pollution modules; damage functions from higher temperatures, pollution, and flooding; and an adaptation module to analyze the economic benefits of adaptation investments to adjust to climate change. Specifically, the extended model incorporates:

- A more disaggregated energy sector, integrated into both the production and consumption sides given the importance of hydrocarbons as a source of GHG emissions and particulate pollutant;
- An emission and pollution module, added to capture the main channels by which economic activity affects climate outcomes;
- Damage functions, introduced to capture how higher temperatures and flooding impact agricultural productivity, worker productivity, and capital stock; and
- Adaptation investment functions, introduced to explain how investments to increase the climate resilience of the economy can reduce damages that might otherwise occur.

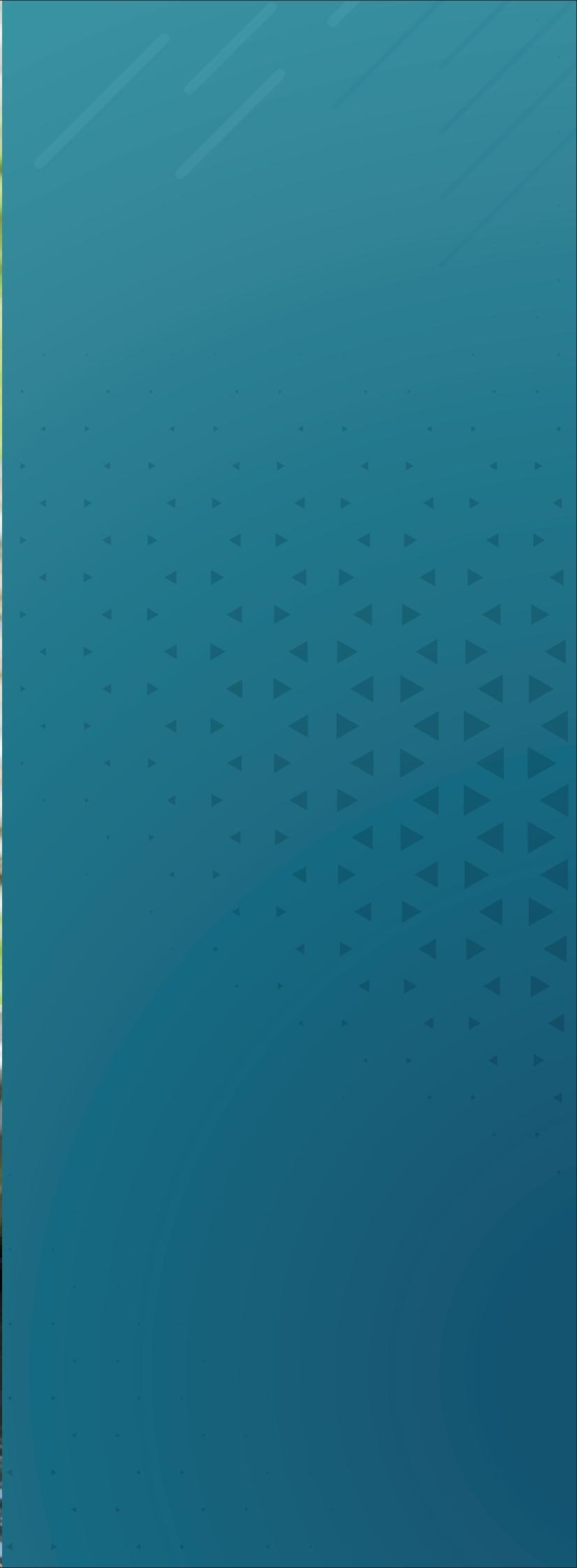
Annex C.1 presents the long-term forecast for the Nepali economy under a baseline (no additional warming) and three warming scenarios. The macro modeling focuses on analyzing the economic impact of climate change rather than mitigation scenarios, as Nepal is a low-carbon emitter and a country that relies largely on hydropower and biofuels as the primary sources of energy.

There are significant limitations to our knowledge of climate impacts. The modeling is carried out under great uncertainty regarding future climate outcomes, technologies, policies, and development paths. It quantifies results under a large set of assumptions to help assess the challenges and trade-offs, but the results do not provide definitive answers and specific numbers should be used cautiously.

<sup>34</sup> Burns, A., B. Campagne, C. Jooste, D. Stephan, and T.T. Bui. 2019. "The World Bank Macro-Fiscal Model Technical Description." World Bank Policy Research Working Papers. Washington, D.C.: World Bank.

<sup>35</sup> Burns, A., C. Jooste, and G. Schwerhoff. 2021. "Climate Modeling for Macroeconomic Policy: A Case Study for Pakistan." World Bank Policy Research Working Papers. Washington, D.C.: World Bank







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